

10 KW
Alternator
Service Manual

3 Φ Y 120/208 35A

3 Φ Δ 120 V 60A

1 Φ Δ 120 V 104A

1 Φ Z 120/240 52A

~~1 Φ~~

12.5 KVA 10 KW .8 PF

Tech-Manual - TM5-6115-244-20

Description

-U.S. Army Corp. of Engineers A.C. Generator

Model-E1645M837D

Serial-286A9-10389N-820

10 KW 12.2 KVA .8P.F.

60 cycle 4 pole 1800 RPM

Manufactured-1962 *for Pacific Mercury*

Output-

120/208 Volts 3 ϕ wye 35 amp

or

120 Volts 3 ϕ delta 60 amp.

or

120/240 Volts 1 ϕ 52 amp.

or

120 Volts 1 ϕ 104 amp.

Manufacturer

-Kurz & Root

Subdivision of Bronson Electronics

1010 N. Meade St.

Appleton, Wis. 54911

Phone (414) 739-9441

— Mr Hartz

*Service dept
Mr McCormick*

Prime Mover

-Continental Motors Corp.

Detroit & Muskegon, Mich.

Model-FS162, Spec 6055

Engine No. 15542

31.4 HP at 2200 RPM

Four cylinder, Flat head,

Liquid cooled, Gasoline fueled

Manufactured Dec. 1962

D.C. Generator

-Prestolite

No. GHP6002AT111T

24 Volt DC

Winterization Heater

-Stewart Warner Corp.

South Wind Division

Indianapolis, Ind.

Model 939-D24

Serial 1545

24 Volt, 11 amp. start, 1 amp. run

Ignition System

Fairbanks Morse Magneto

CW-Type-20

FM-XE4B16W

Serial-4909478

Mfd. for F162M-448

Carburetor

-Marvel Schebler

#TSX-826-62-S

To Polarize Exciter

*f₁ = + } 12 Volts DC
f₂ = - }*

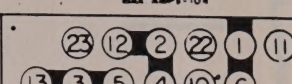
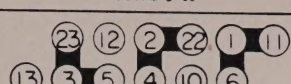
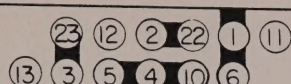
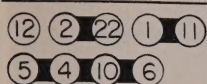
GENERATOR OPERATING CONNECTIONS MAY BE CHANGED TO ANY ONE OF THE FOUR TYPES DESCRIBED BY THE CONNECTIONS AND WIRING DIAGRAMS POSITIONED AS INDICATED IN THE FOUR DIAGRAMS BELOW. LINKS MAY BE CHANGED TO NEW POSITIONS BY LOOSENING THE LOCKING WRENCH SUFFICIENTLY TO ALLOW FREE MOVEMENT. BUTS NEED NOT BE REMOVED AFTER LINKS ARE ARRANGED IN THE NEW POSITION, TIGHTEN ALL NUTS FIRMLY. WHEN LINKS ON TERMINALS 1 AND 4 ARE NOT USED THEY ARE LOCKED IN A VERTICAL POSITION CLEAR OF ALL METAL PARTS. LINKS ARE SPACED AT TWO LEVELS TO PREVENT BENDING. CAUTION: GENERATOR MUST BE STOPPED BEFORE ADJUSTING HOT 24 VOLT TERMINALS WITH TOOLS.

MAX. AMPS-35

MAX. AMPS-52

MAX. AMPS-60

MAX. AMPS-104

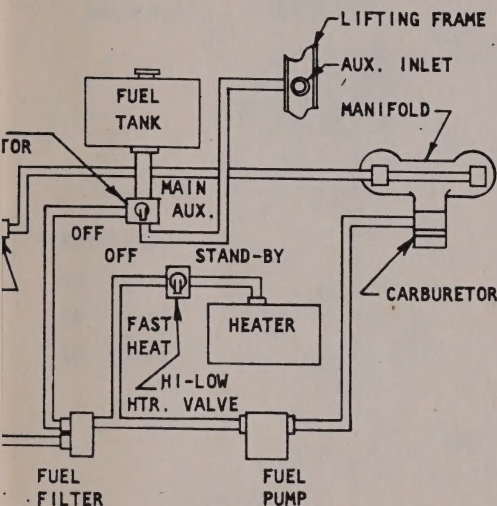


Y 4 WIRE
1. TERMINALS L0 TO L1, L2, & L3.
2. TERMINALS L1 TO L2, L2 TO L3,
- L0 IS COMMON RETURN

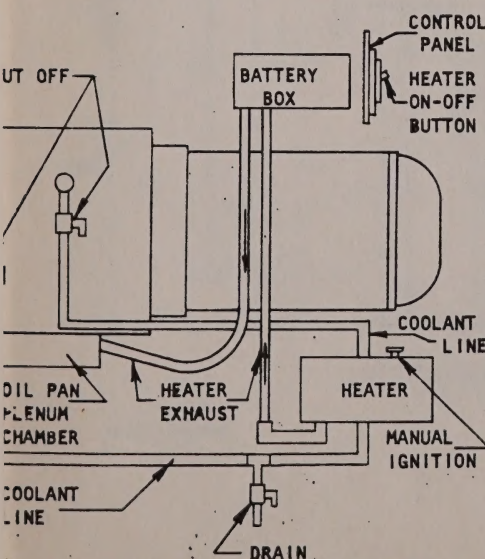
1 PHASE 2 3 WIRE
120 V USE TERMINALS L0 TO L2 OR L0 TO L3
240 V USE TERMINALS L2 TO L3.

3 PHASE Δ 3 WIRE
120 V USE TERMINALS L1, L2, & L3.

1 PHASE Δ 2 WIRE
120 V USE TERMINALS L2, & L3



FUEL SYSTEM DIAGM



WINTERIZATION SYSTEM DIAGM

OPERATING INSTRUCTIONS

FUEL CONTROL

1. TO OPERATE FROM INTEGRAL TANK, TURN FUEL SELECTOR VALVE TO "MAIN" TANK POSITION.
2. TO OPERATE FROM EXTERNAL AUX. SOURCE, ATTACH LINE TO AUXILIARY FITTING IN LIFTING FRAME AND TURN FUEL SELECTOR VALVE TO "AUX." POSITION.
3. TO TURN OFF ALL FUEL FLOW, TURN FUEL SELECTOR VALVE TO "OFF" POSITION.

STARTING ENGINE

1. PLACE CHOKE IN "NEUTRAL" POSITION (CENTER POSITION). PRIME ENGINE FOR COLD WEATHER STARTING.
2. PULL THROTTLE CONTROL ABOUT HALF-WAY OUT.
3. PLACE 3-WAY OPERATIONS SWITCH IN "NORMAL OPERATION."
4. PRESS ENGINE "START" BUTTON UNTIL ENGINE STARTS, BUT NOT OVER 5 SECONDS WITHOUT A 5 SECOND REST PERIOD. ALWAYS PRESS ENGINE "STOP" BUTTON. UNIT IS TO REMAIN INOPERATIVE. MANUAL CHOKING MAY BE DESIRED IN UNUSUAL STARTING CONDITIONS OR AUTOMATIC CHOKE FAILURE. TO MANUALLY CHOK, MOVE CHOKE LEVER FULL RIGHT TO "CLOSED" POSITION. TO MANUALLY OPEN, MOVE CHOKE LEVER FULL LEFT TO "OPEN" POSITION. AUTOMATIC CHOKE POSITION IS THE CENTER POSITION.
5. TO HAND CRANK ENGINE, PLACE 3-WAY OPERATIONS SWITCH IN HAND CRANK POSITION AND ENGAGE CRANK WITH CRANKSHAFT. CRANK WITH A QUICK UPWARD PULL. WHEN ENGINE STARTS, PUSH ENGINE START BUTTON AND RETURN 3-WAY SWITCH TO NORMAL OPERATION.
6. PUSH THROTTLE ALL THE WAY IN TO BRING ENGINE UP TO OPERATING SPEED.
7. PLACE AUTO-MANUAL SWITCH IN POSITION FOR DESIRED OPERATION.
8. USING VOLTAGE ADJUSTMENT KNOB, ADJUST TO DESIRED VOLTAGE FOR SELECTED OPERATION.
9. OPEN FRONT & REAR DRIP PAN VENTILATION PANELS (SEE WINTERIZATION SYSTEM - BELOW)

LOAD APPLICATION

1. PRESS THE "MAIN CONTACTOR ON" SWITCH. THE "POWER ON" LIGHT SHOULD GLOW, AND THE AMMETER SHOULD INDICATE LOAD.
2. CHECK THE CURRENT AND VOLTAGE TO SEE THAT THEY ARE WITHIN THE RATED OPERATION AND CAPACITY. IF EITHER IS IN EXCESS OF THE RATED AMOUNTS, PUSH "MAIN CONTACTOR OFF" SWITCH IMMEDIATELY. CHECK AND ADJUST LOAD BEFORE RE-APPLYING.
3. AFTER UNIT HAS OPERATED UNDER LOAD FOR A SHORT TIME, CHECK AND ADJUST VOLTAGE.

NORMAL STOPPING

1. REMOVE THE ELECTRICAL LOAD BY PRESSING THE "MAIN CONTACTOR OFF" BUTTON.
2. PULL THE THROTTLE CONTROL ALL THE WAY OUT AND ALLOW ENGINE TO IDLE FOR SEVERAL MINUTES.
3. STOP ENGINE BY PRESSING ENGINE "STOP" BUTTON.

EMERGENCY STOPPING

1. EMERGENCY STOPPING MAY BE ACCOMPLISHED BY PRESSING "ENGINE STOP" BUTTON. ALSO IT MAY BE STOPPED BY PLACING 3-WAY OPERATION SWITCH IN "EMER-STOP" POSITION; THIS METHOD MUST BE USED WHEN SET IS OPERATING ON "HAND CRANK" POSITION.

REMOTE OPERATION

1. CONNECT REMOTE CONTROL CABLE TO TERMINALS.
2. AT CONTROL PANEL, PLACE "LOCAL-REMOTE" SWITCH IN "REMOTE" POSITION, PUSH THROTTLE CONTROL ALL THE WAY IN AND CHOKE CONTROL IN "NEUTRAL" POSITION (HALF-WAY POSITION).
3. AT REMOTE STATION PRESS THE "START" BUTTON AND HOLD FOR 3 SECONDS UNTIL ENGINE STARTS. RE-PRESS IF NECESSARY. THE MAIN CONTACTOR WILL CLOSE WHEN ENGINE IS RUNNING AND "START" BUTTON RE-PRESSED.
4. TO STOP ENGINE AND OPEN MAIN CONTACTOR, PRESS ENGINE "STOP" BUTTON AT REMOTE LOCATION. THIS IS NOT RECOMMENDED UNDER FULL LOAD.

WINTERIZATION SYSTEM - AUTOMATIC

1. OPEN ALL COOLANT SHUT-OFF VALVES AND HEATER FUEL LINE VALVES.
2. PLACE HEATER "ON-OFF" SWITCH IN ON POSITION AND ASCERTAIN IF HEATER IS FUNCTIONING PROPERLY BY SOUND OF BLOWER AND COMBUSTION OF FUEL. CHECK FOR FUEL SEEPAGE.
3. PLACE "HI-LOW" FUEL FLOW VALVE IN DESIRED POSITION.
4. PLACE FUEL SELECTOR VALVE IN "MAIN" TANK POSITION.
5. CLOSE FRONT & REAR DRIP PAN VENTILATION PANELS.
6. TO SHUT OFF HEATER, PLACE HEATER "ON-OFF" TO "OFF" POSITION.
7. PLACE "HI-LOW" FUEL FLOW VALVE TO "OFF" POSITION.

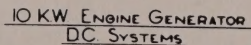
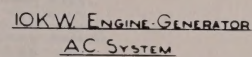
WINTERIZATION SYSTEM - MANUAL IGNITION

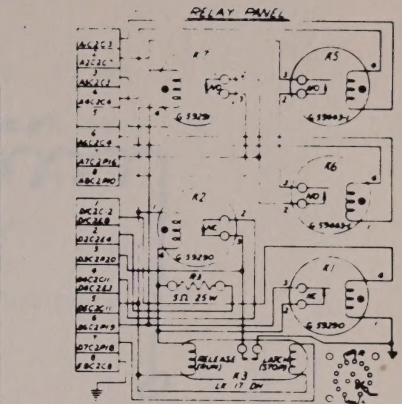
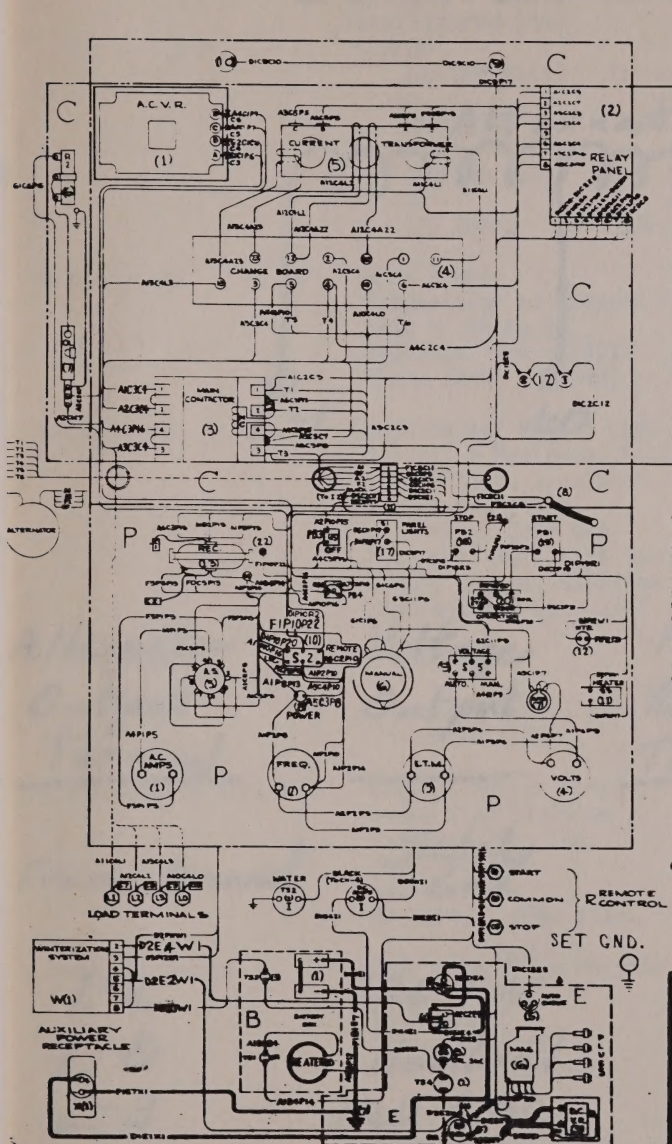
1. PLACE "HI-LOW" FUEL FLOW VALVE IN DESIRED POSITION.
2. PLACE FUEL SELECTOR VALVE IN "MAIN" TANK POSITION.
3. TURN HEATER "ON-OFF" SWITCH TO "ON" POSITION AND LET HEATER RUN ABOUT ONE MINUTE, THEN TURN HEATER OFF.
4. REMOVE CAP AND WICK FROM MANUAL IGNITION TEE AND SOAK WICK WITH FUEL. LIGHT AND REPLACE IN TEE.
5. PLACE HEATER "ON-OFF" SWITCH IN "ON" POSITION WHILE WICK IS BURNING. TIGHTEN CAP WITH FINGER PRESSURE.
6. CLOSE FRONT & REAR DRIP PAN VENTILATION PANELS.

LUBRICATION POINTS

1. THE GENERATOR GROUP DOES NOT REQUIRE LUBRICATION AS SEALED LUBRICATED BEARINGS ARE USED.
2. CONTROL CABLES AND LATCHES MAY BE LUBRICATED WITH A FEW DROPS OF LIGHT MACHINE OIL.
3. APPLY SEVERAL DROPS OF ENGINE OIL TO THE CARBURETOR LINKAGE AND GOVERNOR LINKAGE POINTS.
4. THE FOLLOWING LUBRICANTS ARE RECOMMENDED FOR USE UNDER THE LISTED TEMPERATURE RANGES:
 - a. -65°F. TO 0°F. MIL-O-10295 OIL-ENGINE SUB ZERO.
 - b. 0°F. TO 32°F. MIL-O-2104 OIL-ENGINE, HEAVY DUTY GRADE SAE 10.
 - c. ABOVE PLUS 32°F. MIL-O-2104 OIL-ENGINE HEAVY DUTY GRADE SAE 30.

0M678 5-62





10KW FNG GEN
WIRING LAYOUT

WIRE CODE
CODE IDENTIFY TYPE OF WIRE
AND TERMINATION POINTS OF
EACH WIRE.

- A = AC SYSTEM
- B = BATTERY BOX
- C = CONTROL CABINET
- D = DC SYSTEM
- E = ENGINE AREA
- F = FRAME (GROUND)
- G = GENERATOR SYSTEM
- I = INSTRUMENT PANEL
- L = LOAD TERMINALS
- P = CONTROL CAB PANEL
- R = RELAY CONTROL TERMINALS
- W = WINTERIZATION
- X = AUXILIARY POWER

- PREFIX LETTER
(ELECTRICAL SYSTEM)
- 1st NUMBER
(WIRE OR TERMINAL NO.)
- 1st LETTER
(COMPONENT LOCATION)
- 2nd NUMBER
(COMPONENT NUMBER)
- 2nd LETTER
(COMPONENT LOCATION)
- 3rd NUMBER
(COMPONENT NUMBER)
- (1) (2) ETC. WIRE TERMINATING
LOCATION.

WARNING!

AVOID SHOCK HAZARD BY GROUNDING
SET WITH FRAME "GROUND" STUD.

Description

POWER OUTPUT CONNECTIONS

U.S. Army Corp. of Engineers Generator
 Serial-286A9-10389N-820
 10 KW, 112 V, 3 Phase, 4 Pole, 1800 RPM
 Manufactured-1962
 Output-

120/208 Volts 3 ϕ wye 35 ampor
120 Alternator 100 amp.

100/170 Volt 140 amp.

or
120 Volts 104 amp.

Manufacturer

-Kurz & Root
 Subdivision of Ironson Electronics
 1010 N. Meade St.
 Appleton, Wis. 54911
 Phone (414) 729-9441

Prime Mover

L-1

L-0

L-2

-Continental Motor Corp.
 Detroit & Muskegon, Mich.
 Model-FS162, Spec 6055
 Engine No. 15542
 31.4 HP at 2200 RPM
 Four cylinder, Flat head,
 Liquid cooled, Gasoline fueled
 Manufactured Dec. 1962

Alternator
 Output
 Terminal

Voltage

Output

Plug &

Receptacle

Terminal

Extension

Cord

Color

Frame Ground

Safety
Gnd

W

Green

Ignition System

L-2

120 V. AC

X

Black

L-0

Neutral

Y

White

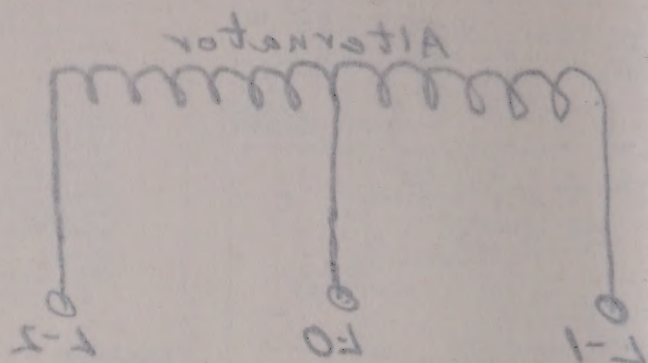
L-3

120 V AC

Z

Red

POWER OUTPUT CONNECTIONS



Extension
Cord
Color

Plug &
Receptacle
Terminal

Voltage
Output

Green

W

Safety
Ground

Black
White
Red

X
Y
Z

120 V. AC
Neutral
120 V. AC

Description	-U.S. Army Corp. of Engineers A.C. Generator Model-E1645M837D Serial-286A9-10389N-820 10 KW 12.2 KVA .8P.F. 60 cycle 4 pole 1800 RPM Manufactured-1962 Output- 120/208 Volts 3 ϕ wye 35 amp or 120 Volts 3 ϕ delta 60 amp. or 120/240 Volts 1 ϕ 52 amp. or 120 Volts 1 ϕ 104 amp.
Manufacturer	-Kurz & Root Subdivision of Bronson Electronics 1010 N. Meade St. Appleton, Wis. 54911 Phone (414) 739-9441
Prime Mover	-Continental Motors Corp. Detroit & Muskegon, Mich. Model-FS162, Spec 6055 Engine No. 15542 31.4 HP at 2200 RPM Four cylinder, Flat head, Liquid cooled, Gasoline fueled Manufactured Dec. 1962
D.C. Generator	-Prestolite No. GHP6002AT111T 24 Volt DC
Winterization Heater	-Stewart Warner Corp. South Wind Division Indianapolis, Ind. Model 939-D24 Serial 1545 24 Volt, 11 amp. start, 1 amp. run
Ignition System	Fairbanks Morse Magneto CW-Type-20 FM-XE4B16W Serial-4909478 Mfd. for F162M-448
Carbureter	-Marvel Schebler #TSX-826-62-S

Open Gate. J.P.

TM 5-6115-244-20

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

RE PARTS

ORGANIZATIONAL MAINTENANCE MANUAL

GENERATOR SET, GASOLINE ENGINE:

1 KW, AC, 120V 1 AND 3 PHASE, 120/240V
SINGLE PHASE, 120/208V 3 PHASE,
60 CYCLE; SKID MOUNTED

(PACIFIC MERCURY MODEL PM59-010-1) SERIAL
NUMBERS 001 THROUGH 900, FSN 6115-690-8290



HEADQUARTERS, DEPARTMENT OF THE ARMY
JANUARY 1962

SAFETY PRECAUTIONS

Before Operation

Do not use a lifting device of less than 2,000 pounds capacity. Do not allow the generator set to swing back and forth while it is suspended. Failure to observe this warning can result in severe injury or death to personnel.

When filling the fuel tank, always provide metal-to-metal contact between the container and fuel tank. This will prevent a spark from being generated as fuel flows over the metallic surface.

Electrolyte contains sulfuric acid and can cause serious skin burns. If the electrolyte comes into contact with the body or clothing, rinse immediately with clean water.

Do not smoke or use an open flame in the vicinity when servicing the batteries. Batteries generate hydrogen, a highly explosive gas.

Do not operate the generator set in an enclosed building unless the exhaust gases are piped to the outside. Exhaust gases contain carbon monoxide, which is a poisonous, odorless, and colorless gas.

Do not operate the generator set without a suitable ground connection. Electrical defects in the unit can cause death by electrocution when contact is made with an ungrounded system.

The fumes produced by the interaction of carbon tetrachloride and heat are deadly. When using an extinguisher in a confined or closed area, use extreme caution so as to avoid breathing of the fumes.

During Operation

Do not fill the fuel tank while the engine is in operation. Gasoline spilled on a hot engine may explode and cause serious injury to personnel.

Do not attempt to make or break connections or perform maintenance on the generator set while it is in operation. Always make sure it is not connected to an energized line before performing maintenance.

Do not operate the generator set in an inclosed building unless the exhaust gases are piped to the outside. Exhaust gases contain carbon monoxide, which is a poisonous, odorless, and colorless gas.

The fumes produced by the interaction of carbon tetrachloride and heat are deadly. When using an extinguisher in a confined or enclosed area, use extreme caution so as to avoid breathing the fumes.

After Operation

Do not smoke or use an open flame in the vicinity when servicing the batteries. Batteries generate hydrogen, a highly explosive gas.

The fumes produced by the interaction of carbon tetrachloride and heat are deadly. When using an extinguisher in a confined or closed area, use extreme caution so as to avoid breathing the fumes.

When filling the fuel tank, always provide metal-to-metal contact between the container and fuel tank. This will prevent a spark from being generated as fuel flows over the metallic surface.

TECHNICAL MANUAL

No. 5-6115-244-20

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., 26 January 1962

Organizational Maintenance Manual

GENERATOR SET, GASOLINE ENGINE: 10 KW, AC, 120V 1 AND 3 PHASE, 120/240V SINGLE
PHASE, 120/208V 3 PHASE, 60 CYCLE; SKID MOUNTED (PACIFIC MERCURY MODEL PM59-010-1)
SERIAL NUMBERS 001 THROUGH 900, FSN 6115-690-8290

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual is published for the use of the personnel to whom the Pacific Mercury, Model PM59-010-1, Generator Set is issued. They provide information on organizational maintenance of the equipment, its accessories, and auxiliaries. This manual also includes instructions for shipment and limited storage.

b. Appendix I contains a list of publications applicable to this manual. Appendix II contains the maintenance allocation chart. The organizational maintenance repair parts and special tool lists are in TM 5-6115-244-20P.

c. Numbers in parentheses on illustrations indicate quantity. Numbers preceding nomenclature callouts on illustrations indicate the preferred maintenance sequence.

d. Report all deficiencies in this manual on

DA Form 2028. Submit recommendations for changes, additions, or deletions to the Commanding Officer, U.S. Army Engineer Maintenance Center, Corps of Engineers, ATTN: EMCDM-5 P.O. Box 119, Columbus 16, Ohio. Direct communication is authorized.

e. Report unsatisfactory equipment performance and suggestions for equipment improvement as specified in AR 700-38.

2. Record and Report Forms

a. DA Form 2258 (Depreservation Guide of Engineer Equipment).

b. For other record and report forms applicable to organizational maintenance, refer to TM 5-505.

Note. Applicable forms, excluding Standard Form 46 which is carried by the operator, shall be kept in a canvas bag mounted on the equipment.

Section II. DESCRIPTION AND DATA

3. Description

TM 5-6115-244-10 provides a general description of the Pacific Mercury, Model PM59-010-1, Generator Set. Specific and detailed descriptions of the components of the generator set are provided in the applicable maintenance paragraphs of this manual.

4. Identification and Tabulated Data

a. *Identification.* Description and locations of major identification plates on the generator set are listed in TM 5-6115-244-10. The generator set has four identification plates on small, interchangeable components.

(1) *Starter plate.* Located on the starter housing. Specifies the manufacturer and model.

(2) *Engine generator plate.* Located on

the engine accessory generator. Specifies the manufacturer and model.

(3) *Magneto plate.* Located on the magneto. Specifies the manufacturer and model.

(4) *Air cleaner plate.* Located on the air cleaner. Specifies the manufacturer and model.

b. *Tabulated Data.* This listing contains information pertinent to organizational maintenance.

(1) Engine.

Manufacturer	Continental Motors Corporation
Model	FS 162
Type	4 cycle, gasoline, L-head
Rated brake horsepower	31.4 at 2,200 rpm (revolutions per minute)

Operating speed.....1,800 rpm
Cylinders.....4
Firing order.....1-3-4-2
Compression ratio.....6.3 to 1
Type cooling.....Liquid
Type lubrication.....Pressure and splash
Normal oil pressure.....20-30 psi (pounds per square inch)

(2) Main generator.

Manufacturer.....Kurz & Root Company
Model.....E1364E1365M837D
Cycles.....60
Speed.....1,800 rpm
Temperature rating.....149° F. (Fahrenheit)
Kva (kilovolt-amperes).....12.5
Kw (kilowatts).....10.0
Power factor.....0.8
Duty.....Continuous
Voltage:

3-phase start connection...120/208-v (volts)
3-phase delta connection...120-v
Single-phase delta connection...120-v
Single-phase Z connection...120/240-v

Amperes:

3-phase star connection...34.7
3-phase delta connection...60
Single-phase delta connection...104
Single-phase Z connection...52

Brushes.....8

(3) Starter.

Manufacturer.....Electric Auto-Lite Company
Model.....MDZ 6001T
Type.....24-v, dc (direct current)
Rotation.....Clockwise, viewed from drive end

(4) Engine generator.

Manufacturer.....Electric Auto-Lite Company
Model.....GHP-6002-AT-1
Type.....24-v, dc
Output.....18 amp (amperes)
Rotation.....Clockwise, viewed from drive end
Control.....Regulator
Polarity.....Negative ground
Brushes.....2

(5) Engine generator regulator.

Manufacturer.....Electric Auto-Lite Company
Model.....VBO-4402-AT-1
Voltage.....24-v, dc
Polarity.....Negative ground

(6) Magneto.

Manufacturer.....Fairbanks-Morse and Company
Model.....FM-XE4B16W
Type.....Shielded
Rotation.....Clockwise, viewed from drive end

(7) Spark plugs.

Manufacturer.....Electric Auto-Lite Company
Model.....BR8S
Type.....Shielded

(8) Oil filter.

Manufacturer.....Fram Corporation
Model.....F3
Type.....Removable element

(9) Air cleaner.

Manufacturer.....Vortex Company
Model.....S60
Type.....Oil bath
Series.....859

(10) Carburetor.

Manufacturer.....Marvel-Schebler Products Division of Borg-Warner Corporation
Model.....TSX826
Type.....Updraft

(11) Fuel filter.

Manufacturer.....AC Spark Plug Division of General Motors Corporation
Model.....T2
Type.....Removable element

(12) Fuel pump.

Manufacturer.....AC Spark Plug Division of General Motors Corporation
Model.....1539837
Type.....Diaphragm

(13) Engine primer pump.

Manufacturer.....Dole Valve Company
Model.....PR7669
Type.....Piston

(14) Winterization heater.

Manufacturer.....South Wind Division of Stewart Warner Corporation
Model.....939-B24
Type.....Gasoline
Fuel pressure.....Gravity feed
Fuel consumption:
High heat.....0.20 gph (gallons per hour)
Low heat.....0.09 gph

Coolant heat output:

High heat-----16,000 Btu (British
thermal units)

Low heat-----5,500 Btu

Voltage-----24 v

Current consumption:

Starting-----11.5 amp

Running-----1.5 amp

Dimensions and weight:

Width-----6¾ in. (inches)

Length-----15 ft in.

Height-----9 in.

Weight-----15 lb (pound)

(15) Nut and bolt torque data.

Cylinder head-----70-75 ft-lb (foot-
pounds)

Manifold-----25-30 ft-lb

Spark plugs-----35 ft-lb

(16) Adjustments.

Spark plug electrode gap-----0.030 in.

Magneto contact set gap-----0.015 in. at full separa-
tion

Valve clearance-----0.014 in.

(exhaust and intake)

Main generator brush spring

tension:

Slip ring-----24 oz (ounces) $\pm$ 2 oz

Commutator-----28 oz $\pm$ 2 oz

Engine generator regulator:

Circuit breaker air gap-----0.034 to 0.040 in.

Circuit breaker contact 0.015 in.

gap.

Voltage regulator gap-----0.048 to 0.052 in.

Current regulator air 0.048 to 0.052 in.

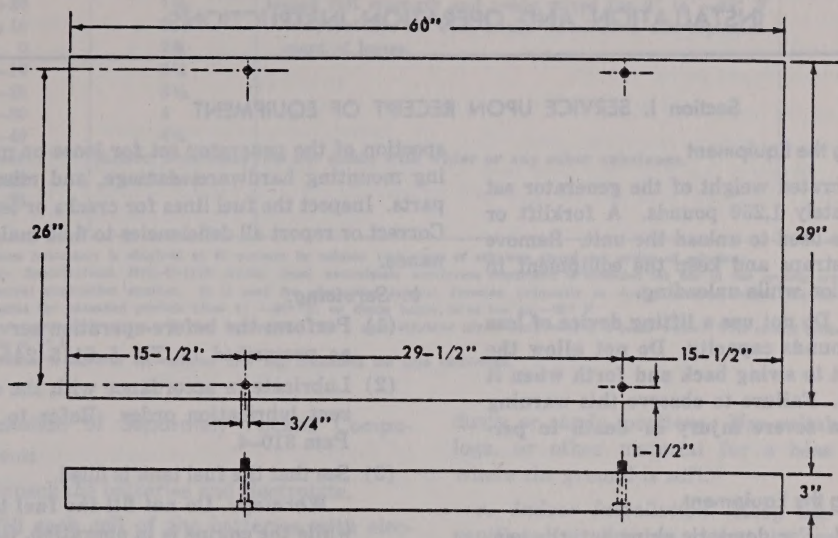
gap.

(17) *Base plan.* Refer to figure 1 for the
base plan.

(18) *Wiring diagram.* Refer to figure 2
for the practical wiring diagram.

5. Difference in Models

This manual covers only the Pacific Mercury,
Model PM59-010-1, Generator Set. No known
unit differences exist for the model covered in
this manual.



EMC 6115-244-20/1

Figure 1. Base plan.

Figure 2. Practical wiring diagram.
(Located in back of manual)

CHAPTER 2

INSTALLATION AND OPERATION INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

6. Unloading the Equipment

The total crated weight of the generator set is approximately 1,250 pounds. A forklift or crane may be used to unload the unit. Remove all tiedown straps and keep the equipment in the UP position while unloading.

Warning: Do not use a lifting device of less than 2,000 pounds capacity. Do not allow the generator set to swing back and forth when it is suspended. Failure to observe this warning can result in severe injury or death to personnel.

7. Unpacking the Equipment

a. *General.* For domestic shipment, the generator set is packed in a crate.

b. *Unpacking.*

- (1) Remove all banding straps from the packing crate.
- (2) Remove the crate from the generator set.

Caution: Exercise care while uncrating to avoid damaging the generator set.

- (3) Check the equipment against the packing list. Correct or report all discrepancies to field maintenance.

c. *Depreservation.* Prepare the generator set for inspection and operation as outlined on DA Form 2258, attached on or near the operational controls.

8. Inspecting and Servicing Equipment

a. *Inspection.* Make a thorough visual in-

spection of the generator set for loose or missing mounting hardware, damage, and missing parts. Inspect the fuel lines for cracks or leaks. Correct or report all deficiencies to field maintenance.

b. *Servicing.*

- (1) Perform the before-operation services as prescribed in TM 5-6115-244-10.
- (2) Lubricate in accordance with the current lubrication order. Refer to DA Pam 310-4.
- (3) See that the fuel tank is filled.

Warning: Do not fill the fuel tank while the engine is in operation. Gasoline spilled on a hot engine may explode and cause serious injury to personnel. When filling the fuel tank, always provide metal-to-metal contact between the container and fuel tank. This will prevent a spark from being generated as fuel flows over the metallic surface.

- (4) Install the electrolyte in the batteries (par. 9) or service the batteries (TM 5-6115-244-10).

Warning: Do not smoke or use an open flame in the vicinity when servicing the batteries. Batteries generate hydrogen, a highly explosive gas.

- (5) Refer to table I for antifreeze solution percentages and to TM 9-207 for detailed cold-weather operation instructions.

Table I. Freezing Points, Composition, and Specific Gravities of Military Antifreeze Materials

Lowest expected ambient temp. ° F.	Pints of inhibited glycol per gal of coolant ¹	Compound, Antifreeze Arctic ²	Ethylene glycol coolant solution specific gravity at 68° F. ³
+20	1½	Issued full strength and ready mixed for 0° to -65° F. temperatures for both initial installation and replenishment of losses.	1.022
+10	2		1.036
0	2¾		1.047
-10	3¼		1.055
-20	3½		1.062
-30	4		1.067
-40	4¾		1.073
-50	Arctic antifreeze preferred	Do not dilute with water or any other substance.	
-60			
-75			

¹ Maximum protection is obtained at 60 percent by volume (4.8 pints of ethylene glycol per gallon of solution).

² Military Specifications MIL-C-1175 Arctic type, nonvolatile antifreeze compound is intended for use in the cooling system of liquid-cooled internal combustion engines. It is used for protection against freezing primarily in Arctic regions where the ambient temperature remains for extended periods close to -40° F. or drops below, to as low as -90° F.

³ Use an accurate hydrometer. To test hydrometer, use 1 part ethylene glycol antifreeze to 2 parts water. This should produce a hydrometer reading of 0° F.

Note. Fasten a tag near the radiator filler cap indicating the type antifreeze.

9. Installation of Separately Packed Components

a. Unpack the batteries and electrolyte.

b. Fill each cell of the batteries with electrolyte to a level of three-eighths inch above the plates. Test the specific gravity of the electrolyte as prescribed in TM 9-6140-200-15.

Warning: Electrolyte contains sulfuric acid and can cause serious skin burns. If the electrolyte comes into contact with the body or clothing, rinse immediately with clean water.

10. Installation or Setting-Up Instructions

a. *General.* The generator set should be installed on a level site, clear of obstacles, and with ample ventilation.

b. *Installation.* The generator set is shipped assembled for operation. When preparing for permanent installation, be sure the base is solid enough to support the weight of the unit. Refer to figure 1 for dimensions of the base. Select a site where there will be sufficient space on all sides for servicing and operation of the equipment. When preparing for temporary installation, move the generator set as close to the work site as practical. Avoid, if possible,

dusty or sandy locations. Use suitable planks, logs, or other material for a base in areas where the ground is soft.

c. *Indoor Installation.* Keep the area well ventilated at all times so that the generator set will receive a maximum supply of air. Install the exhaust extension to pipe the exhaust gases to the outside.

Warning: Do not operate the generator set in an enclosed building unless the exhaust gases are piped to the outside. Exhaust gases contain carbon monoxide, which is a poisonous, odorless, and colorless gas.

d. *Leveling.* Set up the unit as level as possible. Keep the unit as level as possible during operation.

e. *Grounding.* Ground the generator set as instructed in TM 5-6115-244-10. Pay particular attention to the warning note contained in the instructions.

f. *Auxiliary Fuel Connection.* Connect the auxiliary fuel supply as prescribed in TM 5-6115-244-10.

g. *Load Connections.* Refer to TM 5-6115-244-10 for instructions on making load connections.

Section II. MOVEMENT TO A NEW WORKSITE

11. Dismantling for Movement

a. Preparation for Movement.

- (1) Prepare the generator set for movement to a new worksite as directed in TM 5-6115-244-10.
- (2) Remove all anchoring devices.

b. Handling the Generator Set.

- (1) *Movement within immediate area.* If the generator set is to be moved only a short distance and the terrain is

suitable for towing the set, attach a suitable towing device to the towing eye and tow the generator set to the new worksite.

- (2) *Movement from the immediate area or over rough terrain.* Refer to paragraph 167.

12. Reinstallation after movement

Refer to paragraph 10 for reinstallation instructions after movement to a new worksite.

CHAPTER 3

GENERAL MAINTENANCE INSTRUCTIONS

Section I. SPECIAL TOOLS AND EQUIPMENT

13. Special Tools and Equipment

No special tools or equipment are required by organizational maintenance personnel for performing maintenance on the generator set.

14. Organizational Maintenance Repair Parts

Organizational maintenance repair parts are listed and illustrated in TM 5-6115-244-20P.

Section II. PREVENTIVE MAINTENANCE INSTRUCTIONS

15. General

a. Preventive maintenance is performed by organizational maintenance personnel at quarterly intervals. A quarterly interval is equivalent to 3 calendar months, or 250 hours of operation, whichever occurs first.

b. The preventive maintenance services to be performed at quarterly intervals are listed consecutively (starting with number 1) and are described in paragraph 16. The service refers to a Preventive Maintenance Service "Title" on DA Form 464 and indicates the services to be performed. The number listed under "Inspection" indicates the minimum inspection requirements for the equipment.

c. Lubrication shall be as prescribed in TM 5-6115-244-10.

16. Quarterly Preventive Maintenance Services

Service		
Inspection	Quarterly	
		GENERAL
1	1	<i>Before-Operation Services.</i> Inspect and perform services as listed in the operator's daily services (TM 5-6115-244-10).
2	2	<i>Lubrication.</i> Inspect the generator set for damaged oil tubes. Inspect for oil leaks and signs of insufficient lubrication.
	2	Lubricate the generator set as specified in the current lubrication order. Replace missing or damaged fittings.
3	3	<i>Tools and Equipment.</i> Inspect the condition of tools of equipment assigned to the generator set.
	3	See that the tools and equipment are clean, serviceable, and properly stowed or mounted.
4	4	<i>Fire Extinguisher.</i> Inspect a carbon dioxide fire extinguisher for improper charge or damage.
	4	Weigh a monobromotrifluoromethane type fire extinguisher and replace cylinder if gross weight of 2.75 pounds has decreased 4 ounces or more. Lubricate neck threads with 1 drop of OE 30 oil before reassembly. Replace a defective fire extinguisher.
5	5	<i>Publications.</i> See that a copy of TM 5-6115-244-10, TM 5-6115-244-20P, current lubrication order, this manual, and DA Form 285 are on or with equipment and in serviceable condition.

Service		
Inspection	Quarterly	
6	6	<i>Appearance.</i> Inspect the general appearance of the generator set, paying particular attention to dirt, illegible identification markings, and poor condition of the painted surfaces.
	6	Correct all deficiencies or report them to field maintenance.
7	7	<i>Modifications.</i> See that all available modification work orders applying to the generator set have been completed and recorded on DA Form 478, DA Form 5-73, and DA Form 5-73a, as applicable.
ENGINE		
8	8	<i>Cylinder Head, Manifold, and Muffler.</i> Inspect the cylinder head, manifold, and gaskets for leaks, loose or missing mounting hardware, and defective gaskets. Inspect the muffler and raincap for damage and evidence of leakage.
	8	Tighten or replace all loose mounting hardware. Replace a defective cylinder head or gasket (par. 124). Replace a defective manifold or gasket (par. 122). Replace a defective muffler or raincap (par. 121).
9	9	<i>Valve Mechanism.</i> Inspect the valve chamber cover and gasket for signs of leaks. If excessive tappet noise or loss of power is noticed, measure the valve clearance with the engine idling at normal operating temperature. The correct valve clearance for both intake and exhaust valves is 0.014 inch.
	9	Adjust the valves if necessary (par. 128). Replace a damaged valve chamber cover and gasket (par. 127).
10	10	<i>Compression Test.</i> Remove the spark plugs (par. 98). Insert a compression gage into the number one spark plug hole. Rotate the engine until a stabilized reading is obtained on the gage. Test the remaining cylinders and record the reading on DA Form 464. If the gage readings vary more than 10 pounds per square inch, inspect the cylinder head nuts, shoulder studs, and lifting eye for looseness.
	10	Torque all loose nuts, shoulder studs, and lifting eye to 70-75 foot pounds and retest the compression. If low pressure persists, the trouble lies with the cylinder head gasket, valves, or piston rings. Replace a defective cylinder head or gasket (par. 124). Adjust the valves (par. 128). Report equipment having signs of defective valves or worn pistons to field maintenance.
11	11	<i>Crankcase and Breather.</i> Inspect for leaks around the engine crankcase. Inspect the breather line from the valve chamber cover for damage or clogged condition.
	11	Tighten all loose fittings. Replace a damaged valve chamber cover or clean if clogged (par. 127). Correct all oil leaks or report the condition to field maintenance.
12	12	<i>Oil Filter.</i> Inspect the oil filter for loose or missing mounting hardware. Inspect the oil tubes for leaks, breaks, or other damage.
	12	Tighten or replace all loose or missing mounting hardware. Replace the oil filter if defective (par. 93).
13	13	<i>Radiator and Shutter.</i> Inspect the radiator for leaks, dirt in the air passages, and loose or missing mounting hardware. Inspect the manual shutter control for improper operation. Inspect the cooling system hoses for cracks, breaks, or leaks. Test the operating temperature of the cooling system. The shutter should start to open between 170° and 175° Fahrenheit and start to close between 190° and 195° Fahrenheit. If antifreeze is used, check the freezing point of the coolant and record it on DA Form 464.
	13	Drain, flush, and refill a dirty or contaminated cooling system (par. 119). Clean a dirty radiator and report a defective radiator to field maintenance. Repair or replace a defective shutter or shutter controls (par. 114). Replace all defective hoses, making sure the connections are tight. Tighten or replace all loose or missing mounting hardware.
14	14	<i>Water Pump, Fan, and Fan Guard.</i> Inspect the fan and fan guard for insecure mounting. Inspect the water pump for leaks and loose or missing mounting hardware.
	14	Tighten or replace all loose or missing mounting hardware. Replace a damaged fan guard (par. 112). Report a defective fan or water pump to field maintenance.
15	15	<i>Generator Drive Belt and Pulleys.</i> Inspect the generator drive belt for worn, cracked, or frayed condition. Inspect the generator drive belt for misalignment and improper tension between the pulleys. Inspect the pulleys for wear and rough surfaces.

Service		
Inspection	Quarterly	
	15	Aline and adjust the generator drive belt (TM 5-6115-244-10). Replace a defective generator drive belt (par. 107). Remove rough surfaces from the pulleys. Report defective pulleys to field maintenance.
16	16	<i>Oil Pressure Regulator.</i> Check the oil pressure reading on the gage during normal engine operation. The normal operating pressure is 20-30 pounds per square inch at 1,800 revolutions per minute. In the event the oil pressure varies widely from the normal reading, inspect the oil tubes and safety relief valve.
	16	Remove the oil tubes and clean. Pay particular attention to cleaning and adjustment of the oil pressure regulator (par. 95). If the oil pressure continues to vary, report the condition of field maintenance.
17	17	<i>Engine Speed Governor and Linkage.</i> Inspect the external governor controls for insecure mounting and loose or excessively worn parts. Inspect the governor control and linkage for improper functioning while the engine is in operation.
	17	Tighten all loose connections and adjust the engine speed governor (par. 89). Report a defective governor to field maintenance.
18	18	<i>Engine Primer Pump.</i> Inspect the engine primer pump, primer fuel tubes, and fittings for leaks and insecure mounting. Inspect the pump for improper operation.
	18	Tighten or replace all loose or missing mounting hardware and connections. Repair or replace a defective engine primer pump (par. 84).
19	19	<i>Fuel Pump.</i> Inspect the fuel pump for leaks, damage, or loose or missing mounting hardware. Inspect the fuel pump gasket for leaks.
	19	Tighten or replace all loose or missing mounting hardware. Replace a defective fuel pump or gasket (par. 75).
20	20	<i>Carburetor and Linkage.</i> Inspect the carburetor for loose or missing mounting hardware. Inspect all connections and gaskets for leaks. Inspect the linkage for restricted movement and evidence of wear.
	20	Tighten or replace all loose or missing mounting hardware. Adjust or replace a defective carburetor (par. 74).
21	21	<i>Fuel Filter.</i> Inspect the fuel filter for leaks, cracks, insecure mounting, or other damage.
	21	Tighten all loose mounting screws. Service the fuel filter (TM 5-6115-244-10). Repair or replace a defective fuel filter (par. 76).
22	22	<i>Air Cleaner.</i> Inspect the air cleaner for leaks, damage, and insecure mounting. Inspect the oil, paying particular attention to the quantity in the air cleaner.
	22	Service the air cleaner (TM 5-6115-244-10). Be sure the oil is at the proper level. Repair or replace a damaged air cleaner (par. 73).
23	23	<i>Fuel Tank, Cap, and Gasket.</i> Inspect the fuel tank for insecure mounting. Remove the fuel tank cap and strainer. Inspect the fuel strainer for dirt and defects. Inspect the cap, chain, and gasket. Inspect fuel tank for leaks.
	23	Tighten all loose connections and mounting hardware. Replace a damaged fuel tank cap (par. 82) and clean or replace the fuel filter (par. 76). Replace a defective fuel tank (par. 83).
24	24	<i>Fuel Tubes and Hoses.</i> Inspect the fuel tubes and hoses for leaks, loose connections, and damage.
	24	Tighten all loose connections. Replace all damaged fuel tubes, hoses, and fittings (pars. 75 and 79).
25	25	<i>Spark Plugs.</i> Inspect the spark plugs for signs of leakage around the gaskets. Inspect the spark plug wires for looseness at the connections.
	25	Clean and adjust the spark plugs or replace a defective spark plug and gasket (par. 98). Torque the spark plugs to 35 foot-pounds. See that the spark plug wires are tight at the connections.
26	26	<i>Batteries.</i> Inspect the batteries for cracks and leaks. Inspect the condition of the battery box. Inspect all battery cables and terminals for corrosion. Test the specific gravity of the electrolyte in each cell. Record the readings on DA Form 464.
	26	Clean, repair, or replace a corroded or damaged battery cable (par. 109). Clean or replace a corroded or damaged battery box (par. 108). Replace a cracked or leaking battery (TM 5-6115-244-10).
27	27	<i>Engine Generator and Starter.</i> Inspect the engine generator and starter for loose or missing mounting hardware. Inspect the engine generator brushes.

Service		
Inspection	Quarterly	
	27	Tighten or replace all loose or missing mounting hardware. Replace a defective starter (par. 103). Replace defective engine generator brushes or replace a defective engine generator (par. 105).
28	28	<i>Magneto.</i> Inspect the magneto for loose or missing mounting hardware and damage. Inspect the condition and gap setting of the contact set.
	28	Tighten or replace all loose or missing mounting hardware. Adjust or replace the magneto contact set as necessary (par. 99). Replace a defective magneto or gasket (par. 100).
29	29	<i>Wiring and Switches.</i> Inspect all engine electrical leads and connections. Inspect all switches for signs of excessive wear, failure, or other damage.
	29	Tighten or repair all loose connections. Replace defective switches (pars. 144 and 150).
30	30	<i>Engine Generator Regulator.</i> Inspect the engine generator regulator for physical damage and test for internal defects. Inspect the regulator for insecure mountings.
	30	Tighten all loose mounting hardware. Adjust the engine generator regulator or replace a defective engine generator regulator (par. 106).
31	31	<i>Control Panel Lights.</i> Inspect the control panel lights for insecure mounting, damage, and improper operation.
	31	Tighten all loose mounting screws. Replace a defective control panel lamp bulb (TM 5-6115-244-10). Replace a damaged or defective control panel light (par. 154).
32	32	<i>Winterization Heater.</i> Inspect the heater for loose or missing mounting hardware and for improper operation.
	32	Tighten or replace loose or missing mounting hardware. Adjust, repair, or replace a defective heater (par. 164).
33	33	<i>Gages.</i> Inspect the fuel gage, water temperature indicating thermometer, and oil pressure gage for loose or missing mounting hardware, cracked or broken glass, improper operation, or other damage. Inspect for loose connections.
	33	Tighten or replace all loose or missing mounting hardware. Tighten all loose connections. Replace a damaged or defective fuel gage, oil pressure gage, or water temperature indicating thermometer (pars. 81, 131, and 132).
34	34	<i>Battery-Charging Ammeter and Time-Totalizing Meter.</i> Inspect the battery-charging ammeter and time-totalizing meter for loose or missing mounting hardware, cracked or broken glass, loose connections, and other damage.
	34	Tighten or replace all loose or missing mounting hardware. Tighten all loose connections. Replace a damaged or defective battery-charging ammeter or time-totalizing meter (pars. 133 and 139).
35	35	<i>Throttle Control.</i> Inspect the throttle control for excessive wear, loose mounting, and damage.
	35	Tighten all loose mountings. Replace a damaged throttle control (par. 87).
		GENERATOR
36	36	<i>Rheostat.</i> Inspect the rheostat knobs for loose mounting and damage. Inspect the rheostats for improper operation and insecure mounting.
	36	Tighten all loose mountings of the rheostats and knobs. Report a defective rheostat to field maintenance.
37	37	<i>Housing and Skid Base.</i> Inspect the housing and skid base for bends, dents, broken welds or hinges, and other damages. Inspect for loose or missing mounting hardware.
	37	Tighten or replace all loose or missing mounting hardware. Repair or replace damaged parts of the housing (pars. 54 through 71). Report a damaged skid base to field maintenance.
38	38	<i>Armature, Commutator, and Collector Rings.</i> Inspect the armature, commutator, and collector rings for loose mountings, damaged or defective bearings, and worn or defective brushes.
	38	Blow dust and dirt from the generator housing, clean the collector rings, and adjust or replace the brushes (par. 158). Report all other deficiencies to field maintenance.
39	39	<i>Drive Coupling and Ventilating Fan.</i> Inspect the drive coupling and ventilating fan for insecure mounting, breaks, cracks, and other damage.
	39	Tighten all loose mounting screws. Report a damaged or defective drive coupling or ventilating fan to field maintenance.

Service	
Inspection	Quarterly
40	40
	40
41	41
	41

Frequency Meter, Alternating Current Voltmeter, and Alternating Current Ammeter. Inspect the frequency meter, alternating current voltmeter, and alternating current ammeter for loose or missing mounting hardware, cracked or broken glass, loose connections and other damage.

Tighten or replace all loose or missing mounting hardware. Replace a damaged or defective frequency meter, alternating current voltmeter, and alternating current ammeter (pars. 140, 141, and 137).

Wiring and Switches. Inspect all main generator electrical leads and connections. Inspect all switches for signs of excessive wear, failure, or other damage.

Tighten or repair all loose connections. Replace defective switches (pars. 138, 143, 147, 149, 151, and 153). Report all deficiencies which cannot be corrected to field maintenance.

Section III. TROUBLESHOOTING

17. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the generator set and its components. Each trouble symptom stated is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause. Any trouble beyond the scope of organizational maintenance shall be reported to field maintenance, 3d echelon.

18. Engine Fails To Start or Is Hard To Start

Probable cause	Possible remedy
Starter fails to crank engine	Refer to paragraph 28.
Air cleaner and hose dirty or defective	Service the air cleaner (TM 5-6115-244-10). Replace a defective air cleaner (par. 73). Clean or replace a dirty or defective air cleaner-to-carburetor hose (par. 73).
Fuel tank and tubes dirty	Clean the fuel tank and tubes (pars. 83 and 79).
Fuel pump defective	Replace the fuel pump (par. 75).
Carburetor out of adjustment or defective	Adjust or replace the carburetor (par. 74).
Fuel filter dirty or defective	Service the fuel filter (TM 5-6115-244-10) or replace the fuel filter (par. 76).
Main tank three-way valve defective	Replace the main tank three-way valve (par. 78).
Manifold defective	Replace the manifold (par. 122).
Cylinder head defective	Replace the cylinder head (par. 124).
Spark plugs dirty or defective	Clean or replace the spark plugs (par. 98).
Magneto contact set out of adjustment or defective	Adjust or replace the magneto contact set (par. 99).
Magneto improperly timed or defective	Time the magneto to the engine or replace the magneto (par. 100).
Compression poor	Adjust the valves (par. 128). Report any defect to field maintenance.
Oil pressure switch defective	Replace the oil pressure switch (par. 92).
Water temperature switch defective	Replace the water temperature thermometer (par. 132).

19. Engine Misses or Runs Erratically

Probable cause	Possible remedy
Spark plugs dirty or defective	Clean or replace spark plugs (par. 98).
Spark plug wires loose or defective	Tighten loose or replace defective spark plug wires (par. 98).
Magneto contact set out of adjustment or defective	Adjust or replace the magneto contact set (par. 99).
Valves out of adjustment	Adjust the valves (par. 128).

<i>Probable cause</i>	<i>Possible remedy</i>
Carburetor out of adjustment or defective.....	Adjust or replace the carburetor (par. 74).
Manifold or gasket defective.....	Replace the manifold or gasket (par. 122).
Cylinder head or gasket defective.....	Replace the cylinder head or gasket (par. 124).
Engine speed governor out of adjustment or defective.....	Adjust the engine speed governor (par. 89). Report a defective engine speed governor to field maintenance.
Fuel pump defective.....	Replace the fuel pump (par. 75).

20. Engine Stops Suddenly

<i>Probable cause</i>	<i>Possible remedy</i>
Fuel system obstructed by foreign material.....	Clean the fuel system.
Engine overheats.....	Refer to paragraph 22.
Engine has low or no oil pressure.....	Refer to paragraph 25.
Magneto defective.....	Replace the magneto (par. 100).

21. Engine Fails To Stop

<i>Probable cause</i>	<i>Possible remedy</i>
Engine stop switch defective.....	Replace engine stop switch (par. 150).
Engine overheated.....	Refer to paragraph 22.

22. Engine Overheats

<i>Probable cause</i>	<i>Possible remedy</i>
Generator drive belt loose or defective.....	Adjust generator drive belt (TM 5-6115-244-10) or replace generator drive belt (par. 107).
Thermostat fails to open.....	Replace the thermostat (pars. 114 and 115).
Radiator clogged or defective.....	Clean the radiator (par. 16). Report a defective radiator to field maintenance.
Fan or water pump defective.....	Report the condition to field maintenance.

23. Engine Lacks Power

<i>Probable cause</i>	<i>Possible remedy</i>
Compression poor.....	Adjust the valves (par. 128).
Carburetor out of adjustment or defective.....	Adjust or replace the carburetor (par. 74).
Engine speed governor out of adjustment or defective.....	Adjust the engine speed governor (par. 89). Report a defective engine speed governor to field maintenance.
Magneto contact set out of adjustment or defective.....	Adjust or replace the magneto contact set (par. 89).
Magneto out of time or defective.....	Time magneto to engine or replace the magneto (par. 100).
Spark plugs dirty or defective.....	Clean or replace the spark plugs (par. 98).
Muffler defective.....	Replace the muffler (par. 121).

24. Engine Noisy

<i>Probable cause</i>	<i>Possible remedy</i>
Oil pressure low.....	Clean and adjust the oil pressure regulator (par. 95).
Valves out of adjustment.....	Adjust the valves (par. 128).
Magneto improperly timed.....	Time the magneto to the engine (par. 100).

25. Engine Has Low or No Oil Pressure

<i>Probable cause</i>	<i>Possible remedy</i>
Oil pressure regulator dirty, out of adjustment, or defective.....	Clean, adjust, or replace the oil pressure regulator (par. 95).
Oil pressure gage defective.....	Replace the oil pressure gage (par. 131).

26. Engine Exhaust Smoke Excessive

<i>Probable cause</i>	<i>Possible remedy</i>
Carburetor defective or out of adjustment, resulting in improper fuel-air mixture.	Adjust or replace a defective carburetor (par. 74).

27. Engine Oil Consumption High

<i>Probable cause</i>	<i>Possible remedy</i>
Oil pressure regulator dirty, out of adjustment, or defective.	Clean, adjust, or replace the oil pressure regulator (par. 95).
Oil filter or oil tubes dirty or defective.....	Clean, repair, or replace the oil filter or tubes (pars. 93 and 94).

28. Starter Fails To Crank Engine

<i>Probable cause</i>	<i>Possible remedy</i>
Engine start or engine stop switch defective.....	Replace the engine start or engine stop switch (par. 150).
Starter defective.....	Replace the starter (par. 103).
Battery cables loose or corroded.....	Clean and tighten the battery cable connections (par. 109).

29. Battery-Charging Ammeter Indicates Low or No Charging Rate When Batteries Are Low or Discharged

<i>Probable cause</i>	<i>Possible remedy</i>
Engine generator defective.....	Replace a defective engine generator (par. 105).
Engine generator regulator out of adjustment or defective...	Adjust or replace the engine generator regulator (par. 106).
Battery-charging ammeter defective.....	Replace the battery-charging ammeter (par. 133).
Battery-charging circuit wiring connections loose or defective.	Tighten loose wiring connections. Repair or replace defective wiring (par. 130).

30. Battery-Charging Ammeter Indicates Charge When Batteries Are Fully Charged

<i>Probable cause</i>	<i>Possible remedy</i>
Engine generator defective.....	Replace engine generator (par. 105).
Engine generator regulator out of adjustment or defective...	Adjust or replace the engine generator regulator (par. 106).
Battery-charging circuit wiring defective.....	Repair or replace defective wiring (par. 130).
Battery-charging ammeter defective.....	Replace battery-charging ammeter (par. 133).

31. Engine Generator Overheats

<i>Probable cause</i>	<i>Possible remedy</i>
Engine generator defective.....	Replace a defective engine generator (par. 105).
Engine generator regulator out of adjustment or defective...	Adjust or replace a defective engine generator regulator (par. 106).
Battery-charging circuit wiring defective.....	Repair or replace defective wiring (par. 130).

32. Main Generator Fails To Build up Rated Voltage

<i>Probable cause</i>	<i>Possible remedy</i>
Brushes sticking or worn.....	Replace defective brushes (par. 158).
Brushes improperly seated.....	Reseat or replace the brushes (par. 158).
Brush spring tension improper.....	Adjust brush spring tension (par. 158).
Engine lacks power.....	Refer to paragraph 23.

33. Main Generator Voltage Drops Upon Increase of Load

<i>Probable cause</i>	<i>Possible remedy</i>
Brushes worn or out of adjustment.....	Replace defective brushes (par. 158). Report other condition to field maintenance.

34. Main Generator Delivers Erratic Voltage

<i>Probable cause</i>	<i>Possible remedy</i>
Brush contact poor.....	Adjust brush spring tension (par. 158).
Brushes improperly seated or defective.....	Reseat or replace the brushes (par. 158).
Engine misses or runs erratically.....	Refer to paragraph 19.

35. Main Generator Overheats

<i>Probable cause</i>	<i>Possible remedy</i>
Brushes improperly seated.....	Reseat or replace the brushes (par. 158).
Endbell cover dirty or obstructed.....	Clean the endbell cover (par. 157).
Ventilating shroud or screens obstructed.....	Clean the ventilating shroud or screens (par. 157 or 159).

36. Main Generator Frequency Drops Under Load

<i>Probable cause</i>	<i>Possible remedy</i>
Engine lacks power.....	Refer to paragraph 23.

37. Frequency Meter Fails To Register

<i>Probable cause</i>	<i>Possible remedy</i>
Frequency meter defective.....	Replace a defective frequency meter (par. 140).
Frequency meter electrical wiring defective.....	Repair or replace defective frequency meter wiring (par. 130).

38. Alternating Current Voltmeter Fails To Register

<i>Probable cause</i>	<i>Possible remedy</i>
Alternating current voltmeter defective.....	Replace a defective alternating current voltmeter (par. 141).
Alternating current voltmeter electrical wiring defective.....	Repair or replace defective alternating current voltmeter wiring (par. 130).

39. Alternating Current Ammeter Fails To Register

<i>Probable cause</i>	<i>Possible remedy</i>
Alternating current ammeter defective.....	Replace a defective alternating current ammeter (par. 137).
Alternating current ammeter switch defective.....	Replace a defective alternating current ammeter switch (par. 138).
Alternating current ammeter or alternating current ammeter switch electrical wiring defective.....	Repair or replace defective wiring (par. 130).

40. Winterization Heater Overheats, Fails To Ignite, or Fails To Keep Burning

<i>Probable cause</i>	<i>Possible remedy</i>
Fuel tubes or fuel filter dirty or clogged.....	Clean the fuel tubes (par. 79). Service the fuel filter (TM 5-6115-244-10) or replaces the fuel filter (par. 76).
Coolant tubes or exhaust hoses clogged or damaged.....	Clean or replace the coolant tubes or exhaust hoses (pars. 118 and 162).
Fuel solenoid valve defective.....	Replace the fuel solenoid valve (par. 164).
Igniter defective.....	Replace the igniter (par. 164).
Fixed resistor defective.....	Replace the fixed resistor (par. 164).
Flame detector switch defective.....	Replace the flame detector switch (par. 164).
Coolant line thermostatic switch defective.....	Replace the coolant line thermostatic switch (par. 161).
Battery box thermostat defective.....	Replace the battery box thermostat (par. 108).
Overheat control thermostat defective.....	Replace the overheat control thermostat (par. 164).
Heater switch defective.....	Replace the heater switch (par. 144).
Blower motor defective.....	Replace the blower motor and fan assembly (par. 164) or report the condition to field maintenance.
Winterization heater defective.....	Replace the winterization heater (par. 164).

41. Winterization Heater Blower Motor and Fan Assembly Will Not Stop

<i>Probable cause</i>	<i>Possible remedy</i>
Flame detector switch defective.....	Replace a defective flame detector switch (par. 164).

42. Winterization Heater Smokes Excessively Upon Starting

<i>Probable cause</i>	<i>Possible remedy</i>
Igniter defective.....	Replace a defective igniter (par. 164).
Restriction in exhaust hoses.....	Clean the exhaust hoses (par. 162).

Section IV. FIELD EXPEDIENT REPAIRS

43. General

Organizational maintenance troubles may occur while the generator set is operating in the field where supplies and repair parts are not available and normal remedial action cannot be performed. When this condition exists, the following expedient repairs may be used in emergencies, upon the decision of the unit commander. Equipment so repaired must be removed from operation as soon as possible and properly repaired before being placed in operation again.

Warning: Performance of any field expedient repair creates a condition possibly dangerous to equipment or personnel. A generator set so repaired should be taken out of service as soon as possible for replacement of the defective parts.

44. Engine Loses Power

<i>Trouble</i>	<i>Expedient remedy</i>
Air cleaner or air cleaner-to-carburetor hose clogged or damaged.	Remove the air cleaner-to-carburetor hose and securely fasten a suitable section of clean, fine-meshed screen, if available, over the open end of the carburetor and operate the engine without the air cleaner (par. 73d).

Caution: Operating the unit in sandy or dusty areas without an air cleaner or hose can cause damage to the engine.

45. Engine Stops

<i>Trouble</i>	<i>Expedient remedy</i>
Fuel filter clogged	Remove the filter element and operate the engine without an element (par. 76f).

46. Fuel Tube Leaks

<i>Trouble</i>	<i>Expedient remedy</i>
Fuel tube cracked	Tape the cracked fuel tube and operate the engine until the fuel tube can be replaced (par. 79d).

47. Engine Heats up

<i>Trouble</i>	<i>Expedient remedy</i>
Flow control thermostat defective	Remove the thermostat and operate the engine until a new thermostat can be obtained (par. 115d).

48. Shutter Fails To Close

<i>Trouble</i>	<i>Expedient remedy</i>
Shutter control thermostat defective	Remove the thermostat and operate the shutter manually (par. 114g).

49. Shutter Fails To Open

<i>Trouble</i>	<i>Expedient remedy</i>
Shutter control thermostat defective	If the shutter fails to open because of a defective thermostat, the shutter can be operated manually without removal of the thermostat (par. 114g).

50. Alternating Current Ammeter Fails To Register

<i>Trouble</i>	<i>Expedient remedy</i>
Alternating current ammeter defective	Disconnect the electrical leads from the alternating current ammeter. Splice the leads together and tape the connection (par. 137c).

Warning: If it is necessary to operate the generator set with the alternating current ammeter disconnected, short the electrical leads removed from the ammeter and tape the joint. Voltages dangerous to equipment and personnel can result from operating with an open current transformer secondary circuit.

Section V. RADIO INTERFERENCE SUPPRESSION

51. General Methods Used To Attain Proper Suppression

Essentially, suppression is obtained by providing a low resistance path to ground for stray currents. The methods used include shielding the ignition and high-frequency wires, grounding the frame with bonding straps, and using capacitors and resistors. For general information on radio interference suppression, see TM 11-483.

52. Interference Suppression Components Location And Replacement

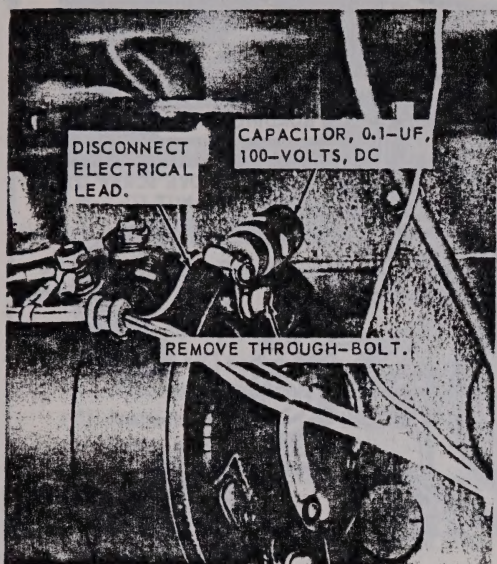
The following illustration (fig. 3) locates, de-

scribes, and provides instructions for removal and installation of the interference suppression components.

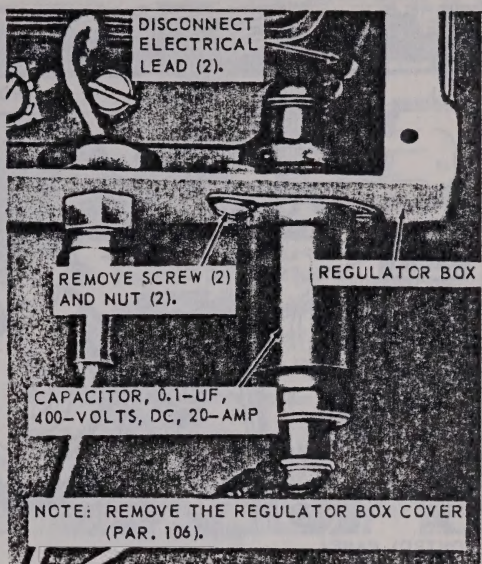
53. Testing of Radio Interference Suppression Components

a. Test the capacitors for leaks and shorts on a capacitor tester; replace defective capacitors. If the test equipment is not available and interference is indicated, isolate the cause of interference by the trial-and-error method of replacing each capacitor in turn until the cause of interference is located and eliminated.

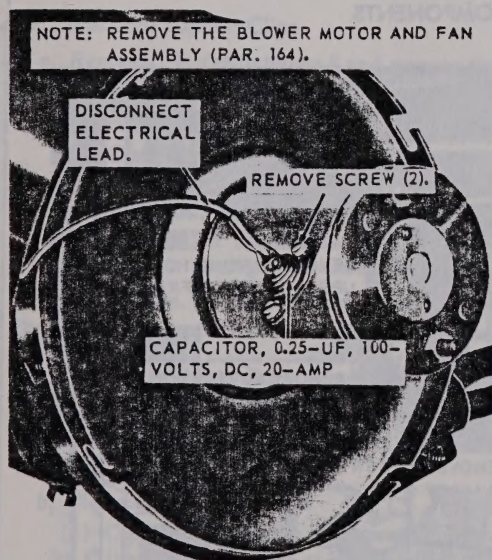
b. Always replace suppression components with identical parts.



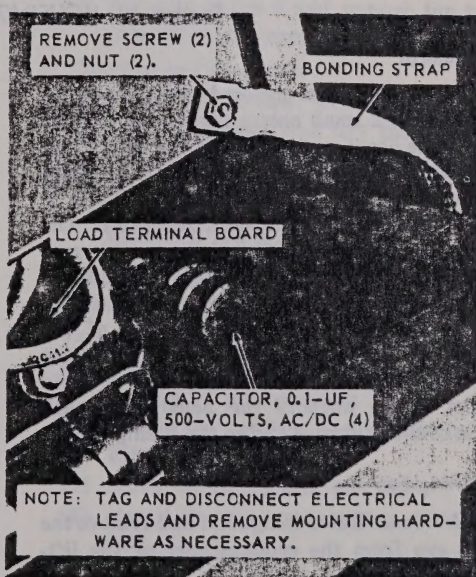
A. ENGINE GENERATOR.



B. ENGINE GENERATOR REGULATOR.



C. WINTERIZATION HEATER.



D. LOAD TERMINAL BOARD.

EMC 6115-244-20/3 ①

Figure 3. Interference suppression components, removal and installation.

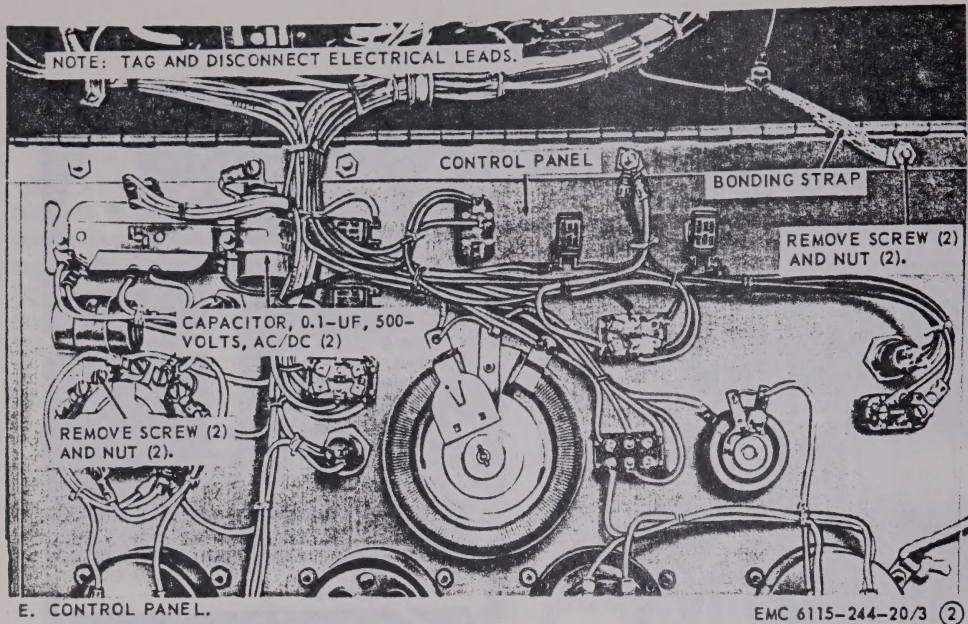


Figure 3—Continued.

Section VI. HOUSING COMPONENTS

54. General

The generator set is enclosed by a sheet metal housing with 2 small access panels and 2 large folding side doors on each side of the unit. Four access doors swing open at the rear of the unit for easy admittance to the control panel and to provide ventilation of the main generator. The shutter, located at the front of the unit, is protected by a grille. The lifting eye extends through the center of the top cowl assembly and is attached to the crossmember of the lifting frame. A towing eye is provided in the skid base at both ends of the unit. A rigid support frame anchors the housing at each corner of the skid base and to the lifting frame.

55. Lifting Eye

a. *Removal.* Refer to figure 4 and remove the lifting eye from the crossmember of the lifting frame.

b. *Cleaning and Inspection.*

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.



Figure 4. Lifting eye, removal and installation.

- (2) Inspect all parts for damage and defects. Replace all parts that are excessively damaged, worn, or defective.

c. Installation. Refer to figure 4 and install the lifting eye through the crossmember of the lifting frame.

56. Side Doors

a. Removal. Refer to figure 5 and remove the side doors from the generator set.

b. Disassembly. Refer to figure 5 and disassemble the side doors.

c. Cleaning and Inspection.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect all parts for breaks, cracks, dents, and other damage.
- (3) Replace any damaged or defective part.

d. Reassembly. Refer to figure 5 and reassemble the side doors.

e. Installation. Refer to figure 5 and install the side doors on the generator set.

57. Side Door Support Clips

a. Removal. Refer to figure 5 and remove the side door support clips from the top cowl.

b. Cleaning and Inspection.

- (1) Clean the side door support clips and mounting hardware with an approved cleaning solvent and dry thoroughly.
- (2) Inspect for damage and defects. Replace a damaged or defective part.

c. Installation. Refer to figure 5 and install the side door support clips on the top cowl.

58. Radiator And Fuel Gage Access Doors

a. Removal. Refer to figure 5 and remove the radiator and fuel gage access doors from the top cowl.

b. Cleaning and Inspection.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the parts for damage and defects. Replace any damaged or defective part.

c. Installation. Refer to figure 5 and install

the radiator and fuel gage access doors on the top cowl.

59. Battery Access Door

a. Removal. Refer to figure 5 and remove the battery access door from the top cowl.

b. Cleaning and Inspection.

- (1) Clean the battery access door with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the door for damage and defects. Replace a damaged or defective battery access door.

c. Installation. Refer to figure 5 and install the battery access door on the top cowl.

60. Top Cowl

a. Removal.

- (1) Remove the fire extinguisher (TM 5-6115-244-10).
- (2) Remove the lifting eye (par. 55).
- (3) Remove the muffler and guard (par. 121).
- (4) Refer to figure 5 and remove the top cowl from the generator set.

b. Cleaning and Inspection.

- (1) Clean the top cowl with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the top cowl for breaks, cracks, dents, defective hinges, and other damage. Inspect the mounting hardware for damage.
- (3) Replace all parts that are excessively damaged, worn, or defective.

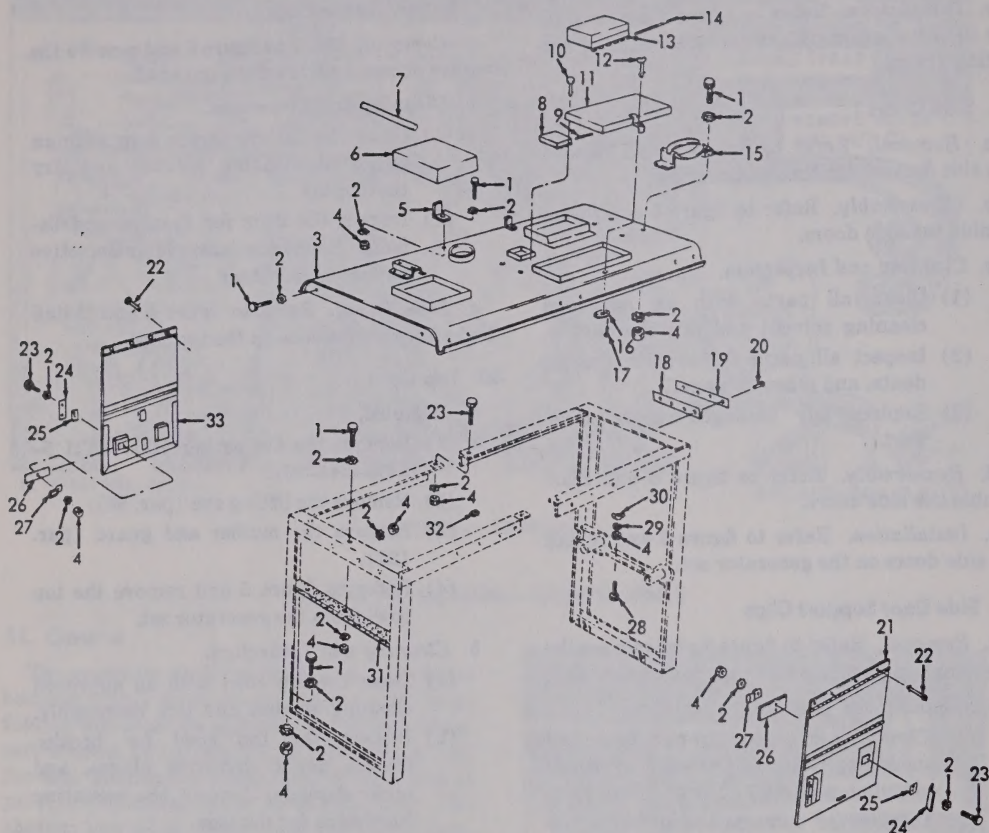
c. Installation.

- (1) Refer to figure 5 and install the top cowl on the generator set.
- (2) Install the muffler and guard (par. 121).
- (3) Install the lifting eye (par. 55).
- (4) Install the fire extinguisher (TM 5-6115-244-10).

61. Fire Extinguisher Brackets

a. Removal.

- (1) Remove the top cowl (par. 60).
- (2) Refer to figure 5 and remove the fire

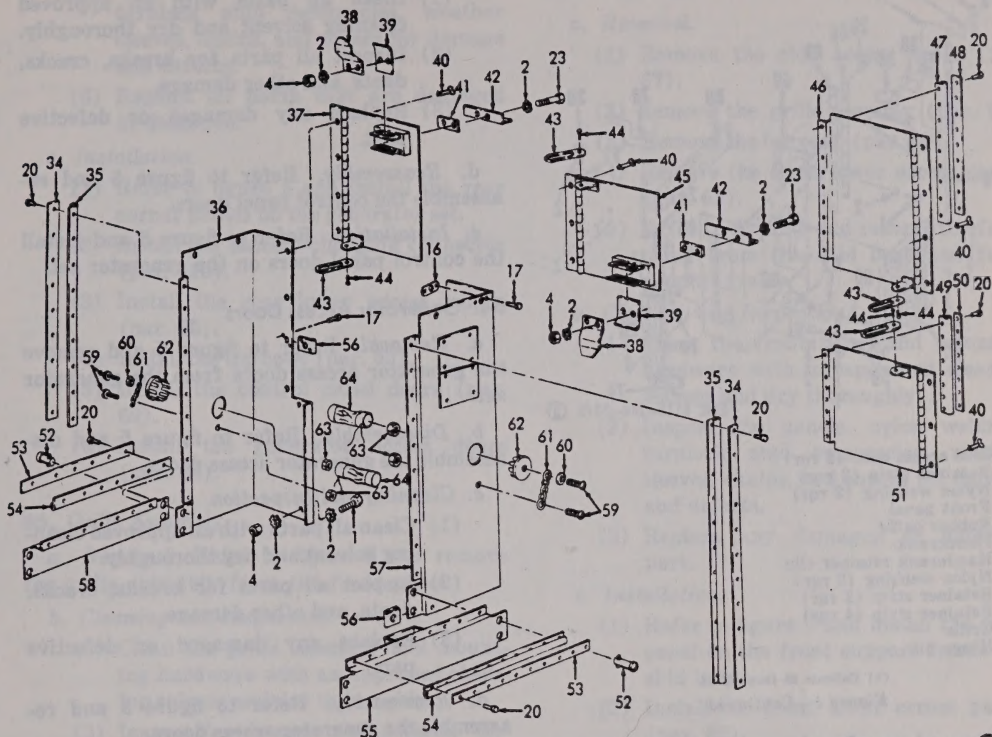


EMC 6115-244-20/5 ①

- | | |
|--|---|
| 1 Screw, cap, hex-hd, $\frac{1}{4}$ -20 x $\frac{1}{2}$ in. (66 rqr) | 18 Nylon webbing |
| 2 Washer, lock, ET, $\frac{1}{4}$ in. | 19 Retainer strip |
| 3 Top cowl | 20 Rivet, aluminum, $\frac{1}{8}$ x $\frac{1}{8}$ in. (107 rqr) |
| 4 Nut, plain, hex, $\frac{1}{4}$ -20 (65 rqr) | 21 Side door (3 rqr) |
| 5 Door support clip (4 rqr) | 22 Turnlock stud (16 rqr) |
| 6 Radiator access door | 23 Screw, cap, hex-hd, $\frac{1}{4}$ -20 x $\frac{3}{8}$ in. (28 rqr) |
| 7 Hinge pin | 24 Handle (8 rqr) |
| 8 Fuel gage access door | 25 Shim (8 rqr) |
| 9 Hinge pin | 26 Spring (8 rqr) |
| 10 Turnlock stud (3 rqr) | 27 Lock (8 rqr) |
| 11 Battery access door | 28 Screw, socket-hd, $\frac{1}{4}$ -20 x 1 in. (4 rqr) |
| 12 Turnlock stud (4 rqr) | 29 Washer, flat, $\frac{1}{4}$ in. (4 rqr) |
| 13 Fuel tank access door | 30 Wingnut, $\frac{1}{4}$ -20 (4 rqr) |
| 14 Hinge pin | 31 Rubber baffle |
| 15 Fire extinguisher bracket (2 rqr) | 32 Nut plate (30 rqr) |
| 16 Turnlock stud receptacle (29 rqr) | 33 Side door (with brackets) |
| 17 Rivet, brass, $\frac{1}{8}$ x $\frac{1}{4}$ in. (68 rqr) | |

(1) Callouts 1 through 33.

Figure 5. Housing components, removal, disassembly, reassembly, and installation.



EMC 6115-244-20/5 (2)

- 34 Retainer strip (2 qqr)
- 35 Nylon webbing (2 qqr)
- 36 Right-hand rear corner panel
- 37 Right-hand control panel door
- 38 Lock (4 qqr)
- 39 Spring (4 qqr)
- 40 Turnlock stud (14 qqr)
- 41 Shim (4 qqr)
- 42 Handle (4 qqr)
- 43 Slide (4 qqr)
- 44 Rivet, steel, $\frac{1}{8}$ x $\frac{1}{4}$ in. (4 qqr)
- 45 Right-hand generator access door
- 46 Left-hand control panel door
- 47 Nylon webbing
- 48 Retainer strip
- 49 Nylon webbing

- 50 Retainer strip
- 51 Left-hand generator access door
- 52 Turnlock stud (16 qqr)
- 53 Retainer strip (4 qqr)
- 54 Nylon webbing (4 qqr)
- 55 Lower access panel (2 qqr)
- 56 Turnlock stud receptacle (24 qqr)
- 57 Left-hand rear corner panel
- 58 Lower access panel (2 qqr)
- 59 Screw, machine, rd-hd, No. 6-32 x $\frac{1}{2}$ in. (6 qqr)
- 60 Washer, flat, No. 6 (3 qqr)
- 61 Chain (3 qqr)
- 62 Cover (3 qqr)
- 63 Nut, plain, hex, No. 6-32 (3 qqr)
- 64 Weather sleeve (3 qqr)

(2) Callouts 34 through 64.

Figure 5—Continued.

extinguisher brackets from the top cowl.

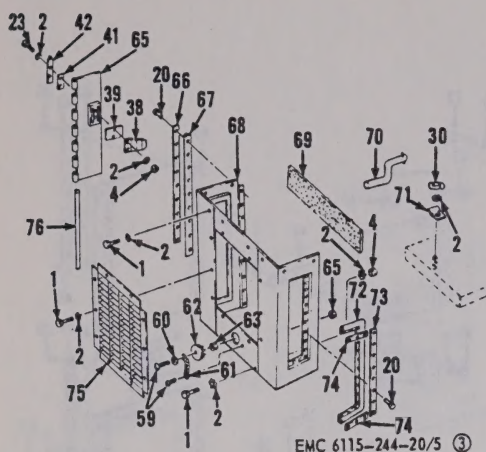
b. Cleaning and Inspection.

- (1) Clean the fire extinguisher brackets and mounting hardware with an approved cleaning solvent and dry thoroughly.

- (2) Inspect for damage and defects. Replace all parts that are damaged or defective.

c. Installation.

- (1) Refer to figure 5 and install the fire extinguisher brackets on the top cowl.
- (2) Install the top cowl (par. 60).



- 65 Side access door (2 rqr)
- 66 Retainer strip (2 rqr)
- 67 Nylon webbing (2 rqr)
- 68 Front panel
- 69 Rubber baffle
- 70 Handcrank
- 71 Handcrank retainer clip
- 72 Nylon webbing (2 rqr)
- 73 Retainer strip (2 rqr)
- 74 Retainer strip (4 rqr)
- 75 Grille
- 76 Hinge pin

(3) Callouts 65 through 76.

Figure 5—Continued.

62. Lower Access Panels

a. *Removal.* Refer to figure 5 and remove the lower access panels from the generator set.

b. *Cleaning and Inspection.*

- (1) Clean the lower access panels with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the panels, nylon webbing, retainer strips, and turnlock studs for damage and defects.
- (3) Replace any damaged or defective part.

c. *Installation.* Refer to figure 5 and install the lower access panels on the generator set.

63. Control Panel Doors

a. *Removal.* Refer to figure 5 and remove the control panel doors from the generator set.

b. *Disassembly.* Refer to figure 5 and disassemble the control panel doors.

c. *Cleaning and Inspection.*

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect all parts for breaks, cracks, dents, and other damage.
- (3) Replace any damaged or defective part.

d. *Reassembly.* Refer to figure 5 and reassemble the control panel doors.

e. *Installation.* Refer to figure 5 and install the control panel doors on the generator set.

64. Generator Access Doors

a. *Removal.* Refer to figure 5 and remove the generator access doors from the generator set.

b. *Disassembly.* Refer to figure 5 and disassemble the generator access doors.

c. *Cleaning and Inspection.*

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect all parts for breaks, cracks, dents, and other damage.
- (3) Replace any damaged or defective part.

d. *Reassembly.* Refer to figure 5 and reassemble the generator access doors.

e. *Installation.* Refer to figure 5 and install the generator access doors on the generator set.

65. Rear Corner Panels

a. *Removal.*

- (1) Remove the generator access doors (par. 64).
- (2) Remove the control panel doors (par. 63).
- (3) Remove the top cowl (par. 60).
- (4) Remove the rear lower access panels (par. 62).
- (5) Remove the battery-charging connector (par. 110).
- (6) Refer to figure 5 and remove the rear corner panels from the generator set.

b. *Cleaning and Inspection.*

- (1) Clean the rear corner panels with an approved cleaning solvent and dry thoroughly.

- (2) Inspect the panels, nylon webbing, turnlock stub receptacles, weather sleeves, chains, and covers for damage and defects.
- (3) Replace all parts that are damaged or defective.

c. Installation.

- (1) Refer to figure 5 and install the rear corner panels on the generator set.
- (2) Install the battery-charging connector (par. 110).
- (3) Install the rear lower access panels (par. 62).
- (4) Install the top cowl (par. 60).
- (5) Install the control panel doors (par. 63).
- (6) Install the generator access doors (par. 64).

66. Grille Assembly

a. Removal. Refer to figure 5 and remove the grille assembly from the front panel.

b. Cleaning and Inspection.

- (1) Clean the grille assembly and mounting hardware with an approved cleaning solvent and dry thoroughly.
- (2) Inspect for damage and defects. Replace any damaged or defective part.

c. Installation. Refer to figure 5 and install the grille assembly on the front panel.

67. Side Access Doors

a. Removal. Refer to figure 5 and remove the side access doors from the front panel.

b. Disassembly. Refer to figure 5 and disassemble the side access doors.

c. Cleaning and Inspection.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect all parts for breaks, cracks, dents, and other damage.
- (3) Replace any damaged or defective part.

d. Reassembly. Refer to figure 5 and reassemble the side access doors.

e. Installation. Refer to figure 5 and install the side access doors on the front panel.

68. Front Panel

a. Removal.

- (1) Remove the side access doors (par. 67).
- (2) Remove the grille assembly (par. 66).
- (3) Remove the top cowl (par. 60).
- (4) Remove the front lower access panels (par. 62).
- (5) Refer to figure 5 and remove the front panel from the skid base and front support frame.

b. Cleaning and Inspection.

- (1) Clean the front panel and mounting hardware with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the panels, nylon webbing, turnlock stud receptacles, weather sleeves, chains, and covers for damage and defects.
- (3) Replace any damaged or defective part.

c. Installation.

- (1) Refer to figure 5 and install the front panel on the front support frame and skid base.
- (2) Install the front lower access panels (par. 62).
- (3) Install the top cowl assembly (par. 60).
- (4) Install the grille assembly (par. 66).
- (5) Install the side access doors (par. 67).

69. Handcrank and Handcrank Retaining Clip

a. Removal. Refer to figure 5 and remove the handcrank and handcrank retaining clip from the skid base.

b. Cleaning and Inspection.

- (1) Clean the parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect for damage and defects. Replace any damaged or defective part.

c. Installation. Refer to figure 5 and install the handcrank and handcrank retaining clip on the skid base.

70. Towing Eyes

a. Removal. Refer to figure 6 and remove the towing eyes from the skid base.

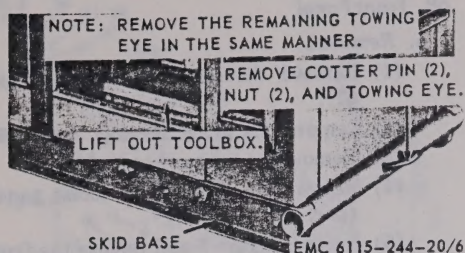


Figure 6. Towing eyes and toolbox, removal and installation.

b. Cleaning and Inspection.

- (1) Clean the towing eyes and hardware with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the towing eyes for damage and defects. Replace all parts that are damaged, worn, or defective.

c. *Installation.* Refer to figure 6 and install the towing eyes through the skid base.

71. Toolbox

a. Removal.

- (1) Remove the right front lower access panel (par. 62).
- (2) Refer to figure 6 and remove the toolbox from the generator set.

b. Cleaning and Inspection.

- (1) Clean the toolbox with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the toolbox for cracks, dents, and a damaged or defective hinge.
- (3) Replace a damaged or defective toolbox.

c. Installation.

- (1) Refer to figure 6 and install the toolbox on the generator set.
- (2) Install the right front lower access panel (par. 62).

Section VII. FUEL SYSTEM

72. General

The fuel system consists of an oil bath air cleaner, carburetor, fuel pump, fuel assembly, fuel tank, fuel gage, engine speed governor, engine primer pump, and the necessary valves, tubes, hoses, and fittings. The fuel pump draws fuel from the fuel supply through the fuel filter and pumps it to the carburetor. The amount of fuel supplied by the carburetor is controlled by the engine speed governor and choke control. The carburetor mixes the fuel with clean air supplied by the air cleaner and passes the mixture into the combustion chamber. The engine primer pump injects fuel, through the nozzles, into the intake portion of the manifold for cold weather starting.

73. Air Cleaner, Air Cleaner-to-Carburetor Hose, and Air Cleaner Mounting Brackets

a. Removal.

- (1) Refer to figure 7 and remove the air cleaner, air cleaner-to-carburetor hose, and air cleaner mounting brackets from the generator set.

- (2) Refer to TM 5-6115-244-10 and remove the cup and chamber from the air cleaner body.

b. Cleaning and Inspection.

- (1) Clean all parts in an approved cleaning solvent and dry thoroughly.
- (2) Inspect the parts for cracks, breaks, dents, and other damage.
- (3) Replace all parts that are excessively damaged, worn, or defective.

c. Installation.

- (1) Refer to TM 5-6115-244-10 and install the chamber and cup to the air cleaner body.
- (2) Refer to figure 7 and install the air cleaner, air cleaner-to-carburetor hose, and air cleaner mounting brackets on the generator set.

d. *Field Expedient Repair.* In the event the engine loses power suddenly because of stoppage of the air cleaner or hose, remove the air cleaner-to-carburetor hose and securely fasten a suitable section of clean, fine-meshed screen,

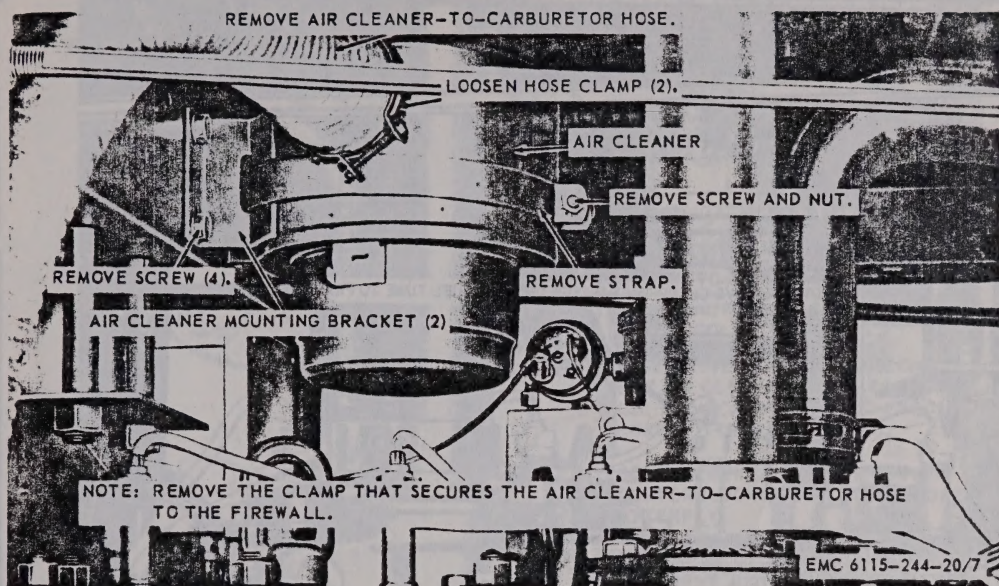


Figure 7. Air cleaner, air cleaner-to-carburetor hose, and air cleaner mounting brackets, removal and installation.

if available, over the open end of the carburetor and operate the engine without the air cleaner.

Caution: Operating the unit in sandy or dusty areas without the air cleaner can cause damage to the engine.

74. Carburetor

a. Removal. Refer to figure 8 and remove the carburetor from the manifold.

b. Cleaning and Inspection.

- (1) Clean the carburetor with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the carburetor for cracks, breaks, loose or missing screws, damaged bowl gasket, and other damage.
- (3) Tighten or replace loose or missing screws. Replace a damaged or defective bowl gasket (*c* below). Replace a damaged or defective carburetor.

c. Service. Refer to figure 9 and service the carburetor.

d. Installation. Refer to figure 8 and install the carburetor on the manifold.

e. Adjustment. Refer to figure 10 and adjust the carburetor and automatic choke.

75. Fuel Pump

a. Removal.

- (1) Refer to figure 11 and remove the fuel pump from the engine.
- (2) Refer to TM 5-6115-244-10 and remove the screen from the fuel pump.

b. Cleaning and Inspection.

- (1) Clean the fuel pump and mounting hardware with an approved cleaning solvent and dry thoroughly.
- (2) Inspect for breaks, cracks, and other damage.
- (3) Replace all parts that are excessively worn, damaged, or defective.

c. Installation.

- (1) Refer to TM 5-6115-244-10 and install the screen in the fuel pump.

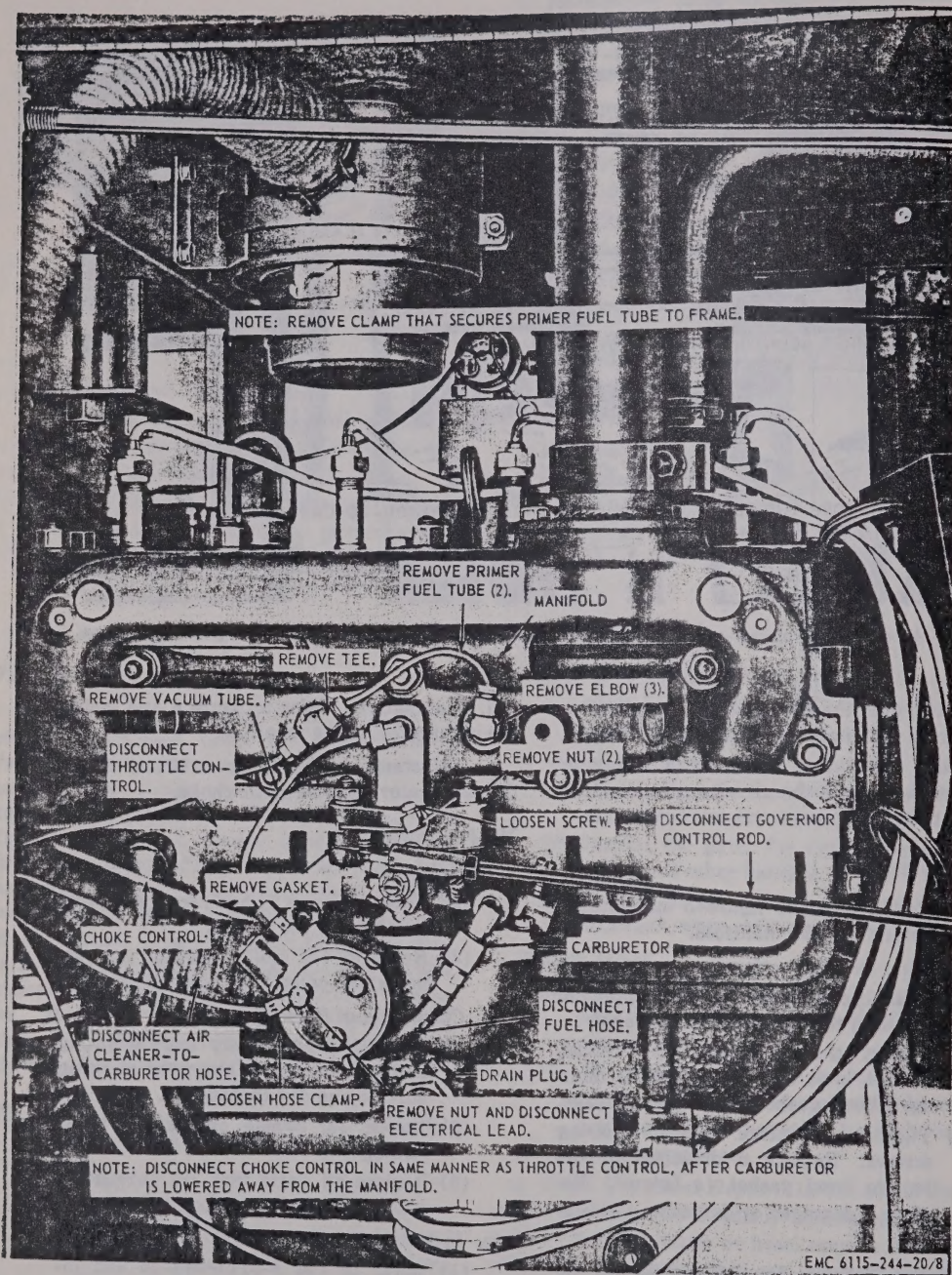
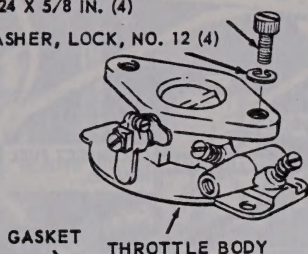


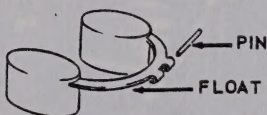
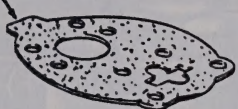
Figure 8. Carburetor and primer tubes and fittings, removal and installation.

SCREW, MACHINE, NO. 12-
24 X 5/8 IN. (4)

WASHER, LOCK, NO. 12 (4)

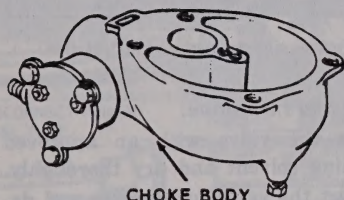


GASKET
THROTTLE BODY



PIN

FLOAT



CHOKE BODY

EMC 6115-244-20/9

Figure 9. Carburetor, service.

- (2) Refer to figure 11 and install the fuel pump on the engine.

76. Fuel Filter

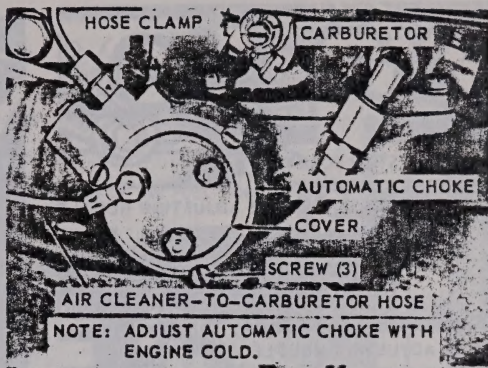
a. Removal.

- (1) Place the main tank, three way fuel valve in the OFF position (TM 5-6115-244-10).
- (2) Refer to figure 12 and remove the fuel filter from the mounting bracket.

b. Disassembly. Refer to figure 13 and disassemble the fuel filter.

c. Cleaning and Inspection.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.



STEP 1. LOOSEN HOSE CLAMP AND DISCONNECT AIR CLEANER-TO-CARBURETOR HOSE FROM CARBURETOR TO EXPOSE CHOKE BUTTERFLY.

STEP 2. LOOSEN SCREW (3) AND TURN COVER COUNTERCLOCKWISE TO OPEN CHOKE BUTTERFLY.

STEP 3. TURN COVER CLOCKWISE UNTIL CHOKE BUTTERFLY JUST CLOSES AND TIGHTEN SCREW (3).

STEP 4. CONNECT AIR CLEANER-TO-CARBURETOR HOSE TO CARBURETOR AND TIGHTEN HOSE CLAMP.

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Automatic adjustment

Figure 10. Carburetor and automatic choke, adjustments.

- (2) Inspect the parts for damage and defects.

- (3) Replace all parts that are excessively damaged, worn, or defective.

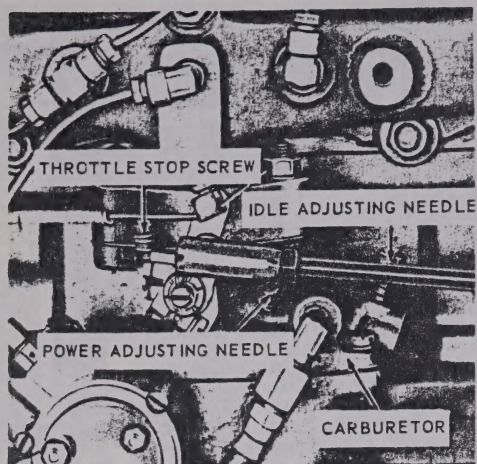
d. Reassembly. Refer to figure 13 and reassemble the fuel filter.

e. Installation. Refer to figure 12 and install the fuel filter on the mounting bracket.

f. Field Expedient Repair. In the event the engine stops suddenly due to a clogged fuel filter, remove the filter element and operate the engine without an element.

77. Heater Three-Way Fuel Valve

a. Removal. Refer to figure 12 and remove the heater three-way fuel valve from the fuel tubes.



STEP 1. SET THE BASIC SETTING OF IDLE ADJUSTING NEEDLE 1-1/2 TURNS COUNTERCLOCKWISE FROM FULLY CLOSED POSITION AND 1-1/4 TURNS FOR POWER ADJUSTING NEEDLE.

STEP 2. START ENGINE AND BRING UP TO OPERATING TEMPERATURE (TM 5-6115-244-10).

STEP 3. TURN THROTTLE STOP SCREW CLOCKWISE TO INCREASE IDLE SPEED (600-800 RPM) AND COUNTERCLOCKWISE TO DECREASE IDLE SPEED.

STEP 4. PULL THROTTLE ALL THE WAY OUT AND TURN IDLE ADJUSTING NEEDLE CLOCKWISE UNTIL ENGINE BEGINS TO LOSE SPEED. TURN COUNTERCLOCKWISE UNTIL ENGINE AGAIN LOSES SPEED. TURN IDLE ADJUSTING NEEDLE BETWEEN THESE TWO POINTS UNTIL SMOOTHEST IDLE SPEED IS OBTAINED.

STEP 5. PUSH THROTTLE IN AND TURN POWER ADJUSTING NEEDLE CLOCKWISE UNTIL ENGINE BEGINS TO LOSE SPEED. TURN COUNTERCLOCKWISE UNTIL ENGINE AGAIN LOSES SPEED. TURN POWER ADJUSTING NEEDLE BETWEEN THESE TWO POINTS UNTIL SMOOTHEST MAXIMUM SPEED IS OBTAINED. IF NECESSARY, ADJUST THE ENGINE SPEED GOVERNOR (PAR. 89) TO OBTAIN 1,800 RPM.

EMC 6115-244-20/10 ②

Carburetor adjustment
Figure 10—Continued.

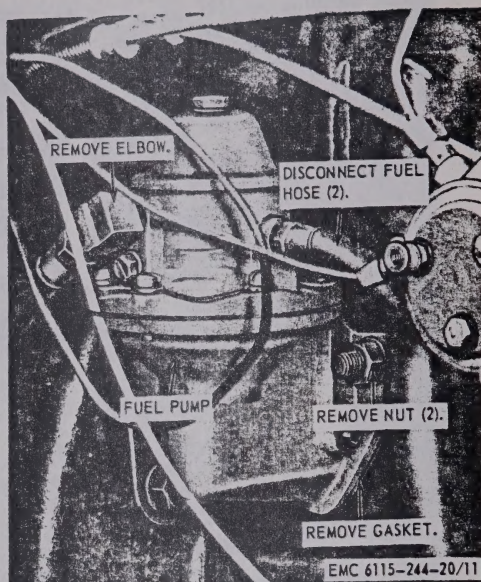


Figure 11. Fuel pump, removal and installation.

b. Cleaning and Inspection.

- (1) Clean the valve with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the valve for damage and defects. Replace a damaged or defective valve.

c. *Installation.* Refer to figure 12 and install the heater three-way fuel valve between the fuel tubes.

78. Main Tank Three-Way Fuel Valve

a. *Removal.* Refer to figure 12 and remove the main tank three-way fuel valve from the fuel tank.

b. Cleaning and Inspection.

- (1) Clean the valve with an approved cleaning solvent and dry thoroughly.
- (2) Inspect for damage and defects. Replace a damaged or defective valve.

c. *Installation.* Refer to figure 12 and install the main tank three-way fuel valve in the fuel tank.

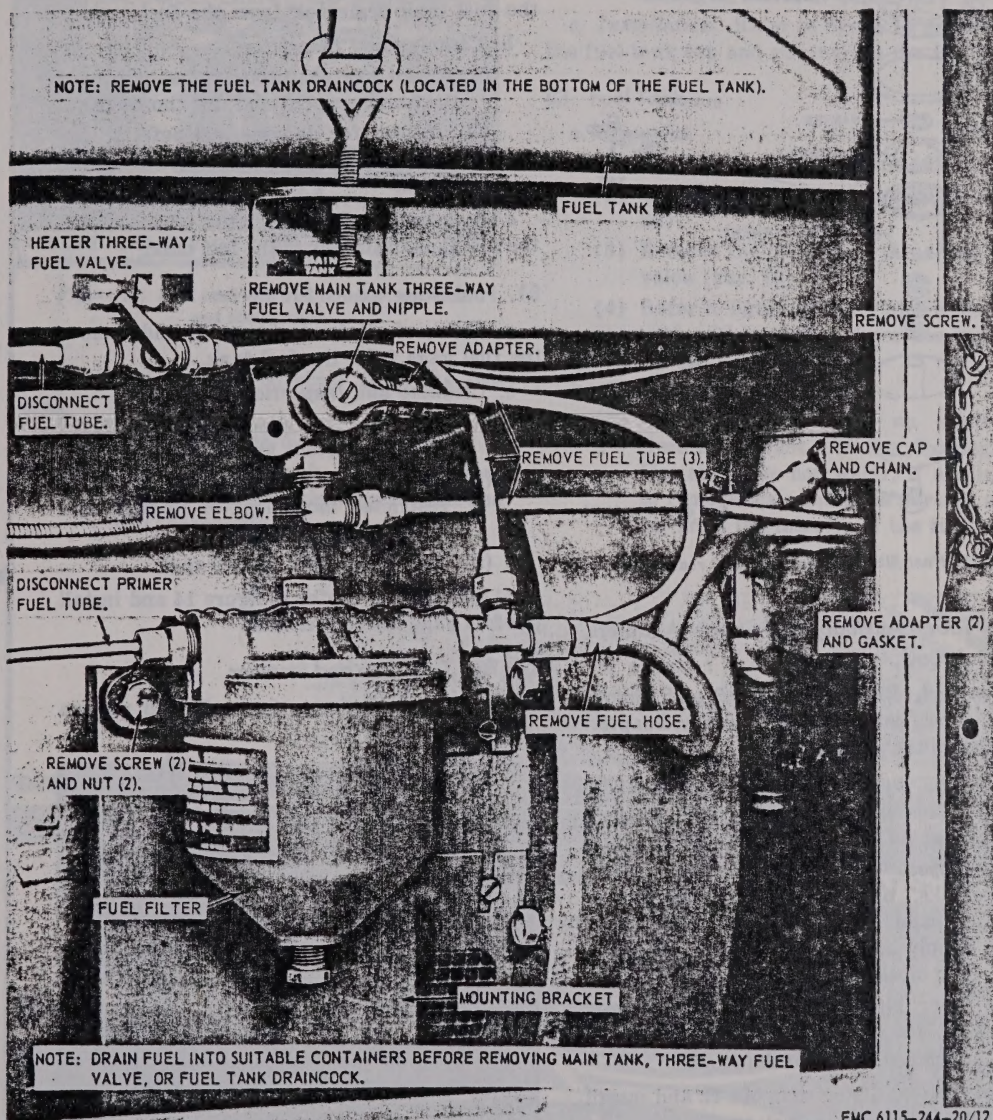


Figure 12. Fuel filter, main tank and heater three-way fuel valves, fuel tank draincock, and auxiliary fuel supply adapters and cap, removal and installation.

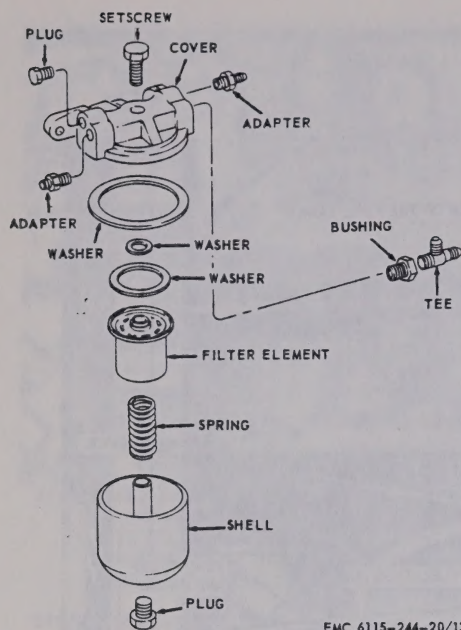


Figure 13. Fuel filter, disassembly and reassembly.

79. Fuel Tubes, Auxiliary Fuel Supply Adapters, and Cap

a. *Removal.* Refer to figure 12 and remove the fuel tubes, auxiliary fuel supply adapter, and cap from the generator set.

b. *Cleaning and Inspection.*

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the fuel tubes for cracks, kinks, blocked passages, and other damage. Inspect the auxiliary fuel supply adapters and caps for damage and blocked passages.
- (3) Clear blocked passages and reclean. Replace all parts that are excessively damaged, worn, or defective.

c. *Installation.* Refer to figure 12 and install the fuel tubes, auxiliary fuel supply adapters, and cap on the generator set.

d. *Field Expedient Repair.* In the event a loss of fuel is noticed due to a cracked fuel

tube, tape the cracked tube and operate the engine until the tube can be replaced.

80. Fuel Tank Draincock

a. *Removal.* Refer to figure 12 and remove the fuel tank draincock from the fuel tank.

b. *Cleaning and Inspection.*

- (1) Clean the draincock in an approved cleaning solvent and dry thoroughly.
- (2) Inspect for damage and defects. Replace a damaged or defective draincock.

c. *Installation.* Refer to figure 12 and install the fuel tank draincock in the fuel tank.

81. Fuel Gage

a. *Removal.* Refer to figure 14 and remove the fuel gage from the fuel tank.

b. *Cleaning and Inspection.*

- (1) Clean the fuel gage with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the fuel gage for bends, cracks, restricted movement of linkage, and other damage.
- (3) Replace a defective fuel gage.

c. *Installation.* Refer to figure 14 and install the fuel gage in the fuel tank.

82. Fuel Tank Cap and Strainer

a. *Removal.* Refer to figure 15 and remove

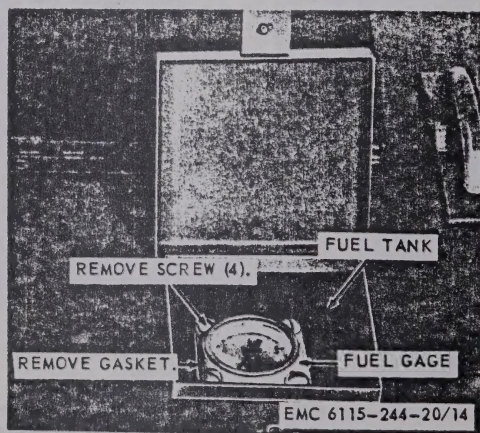


Figure 14. Fuel gage, removal and installation.

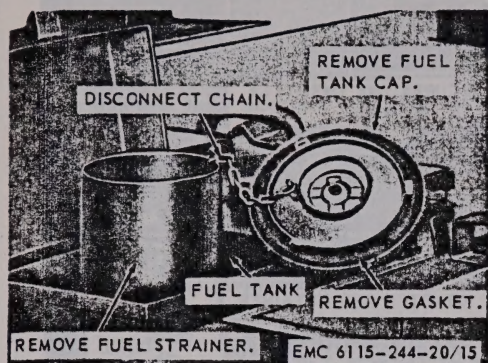


Figure 15. Fuel tank cap and strainer, removal and installation.

the fuel tank cap and strainer from the fuel tank.

b. Cleaning and Inspection.

- (1) Clean the fuel tank cap and strainer with an approved cleaning solvent and dry thoroughly.

- (2) Inspect the cap, strainer, and gasket for breaks, cracks, tears, and other damage.

- (3) Replace all parts that are excessively damaged, worn, or defective.

c. Installation. Refer to figure 15 and install the fuel tank cap and strainer on the fuel tank.

83. Fuel Tank

a. Removal.

- (1) Remove the top cowl (par. 60).
- (2) Remove the fuel tank draincock (par. 80).
- (3) Remove the main tank three-way fuel valve (par. 78).
- (4) Refer to figure 16 and remove the fuel tank and insulation from the generator set.

b. Cleaning and Inspection.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly. Use steam or hot water, if available, to remove scale and other foreign matter from the interior of the fuel tank.

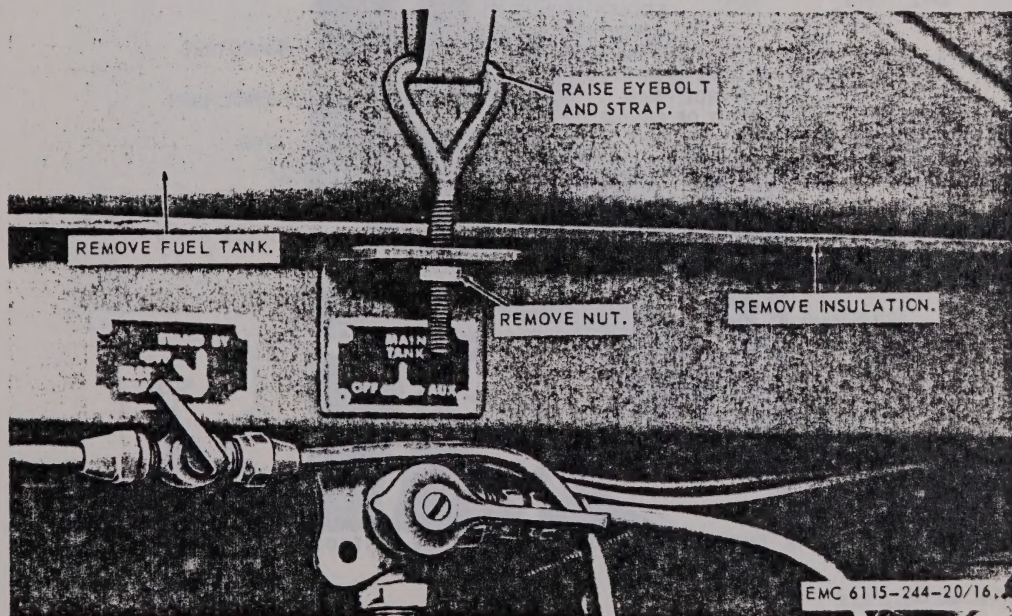
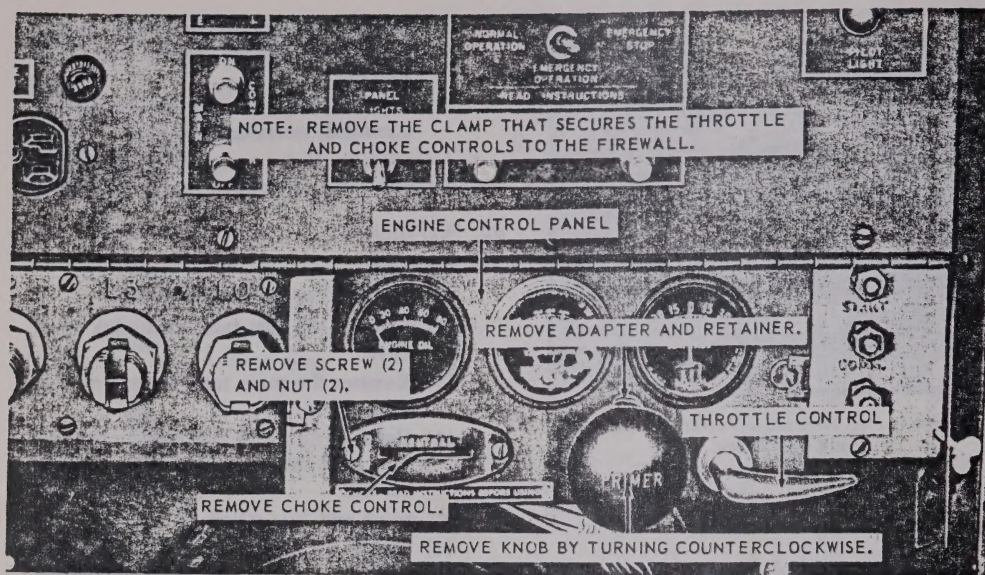
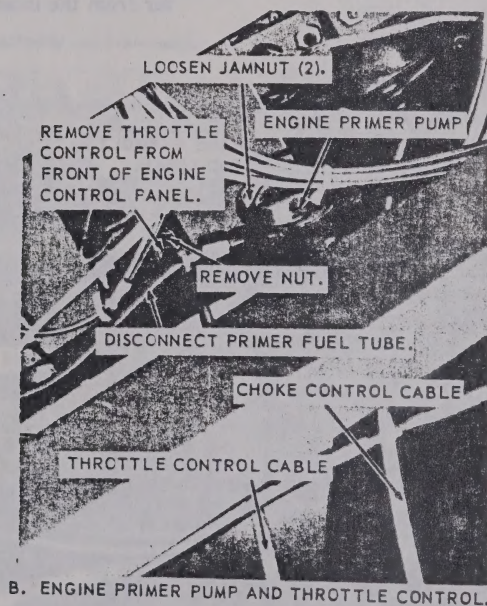


Figure 16. Fuel tank, removal and installation.



A. ENGINE PRIMER PUMP AND CHOKE CONTROL.



B. ENGINE PRIMER PUMP AND THROTTLE CONTROL.

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Figure 17. Engine primer pump, choke control, and throttle control, removal and installation.

- (2) Inspect the fuel tank and insulation for cracks, breaks, and other damage. Inspect the mounting hardware and straps for damage.

- (3) Replace any damaged or defective part.

c. Installation.

- (1) Refer to figure 16 and install the insulation and fuel tank on the generator set.
- (2) Install the main tank three-way fuel valve (par. 78).
- (3) Install the fuel tank draincock (par. 80).
- (4) Install the top cowl (par. 60).

84. Engine Primer Pump

- a. Removal.* Refer to figure 17 and remove the engine primer pump from the engine control panel.

- b. Disassembly.* Refer to figure 18 and disassemble the engine primer pump.

c. Cleaning, Inspection, and Repair.

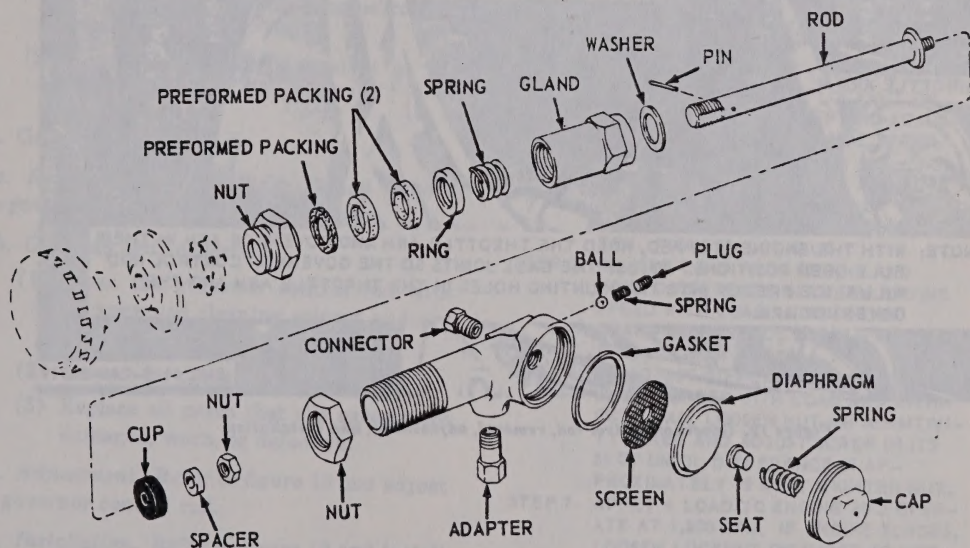
- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the parts for damage and defects.
- (3) Repair or replace all parts that are excessively damaged, worn, or defective.

- d. Reassembly.* Refer to figure 18 and reassemble the engine primer pump.

- e. Installation.* Refer to figure 17 and install the engine primer pump in the engine control panel.

85. Primer Fuel Tubes and Fittings

- a. Removal.* Refer to figure 8 and remove the primer fuel tubes and fittings from the generator set.



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Figure 18. Engine primer pump, disassembly and reassembly.

b. Cleaning and Inspection.

- (1) Clean the tubes and fittings with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the tubes and fittings for cracks, kinks, blocked passages, and other damage.
- (3) Clear blocked passages and reclean. Replace all parts that are excessively damaged, worn, or defective.

c. Installation. Refer to figure 8 and install the primer fuel tubes and fittings on the generator set.

86. Choke Control

a. Removal.

- (1) Remove the carburetor (par. 74).
- (2) Refer to figure 17 and remove the choke control from the engine control panel.

b. Cleaning and Inspection.

- (1) Clean the choke control with a cloth dampened with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the choke control for damage and defects. Replace a damaged or defective hand choke.

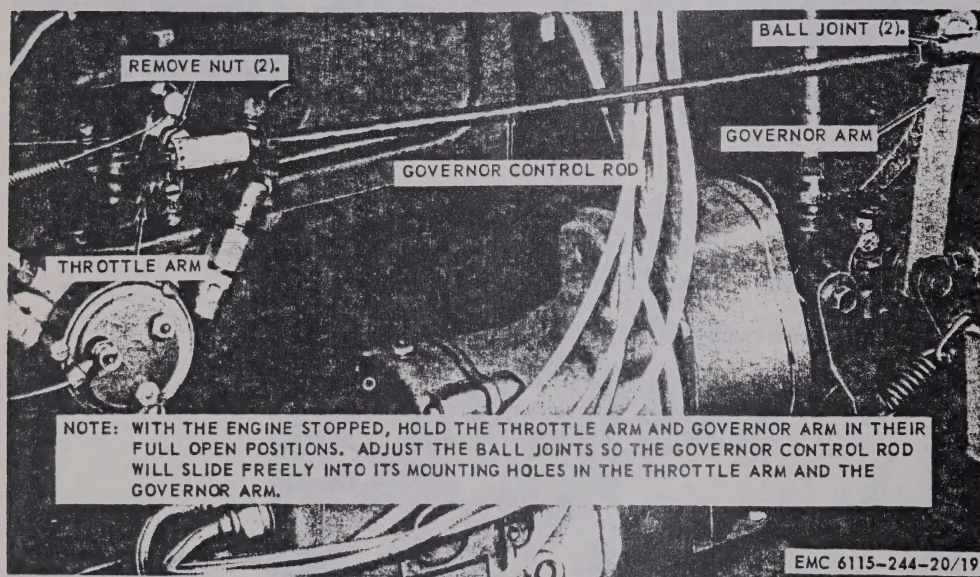


Figure 19. Governor control rod, removal, adjustment, and installation.

c. Installation.

- (1) Refer to figure 17 and install the choke control in the engine control panel.
- (2) Install the carburetor (par. 74).

87. Throttle Control

a. Removal.

- (1) Disconnect the throttle control at the carburetor (par. 74).
- (2) Refer to figure 17 and remove the throttle control from the engine control panel.

b. Cleaning and Inspection.

- (1) Clean the throttle control with a cloth dampened with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the throttle control for damage and defects. Replace a damaged or defective throttle control.

c. Installation.

- (1) Refer to figure 17 and install the throttle control in the engine control panel.
- (2) Connect the throttle control at the carburetor (par. 74).

88. Governor Control Rod

a. Removal. Refer to figure 19 and remove the governor control rod from the engine.

b. Cleaning and Inspection.

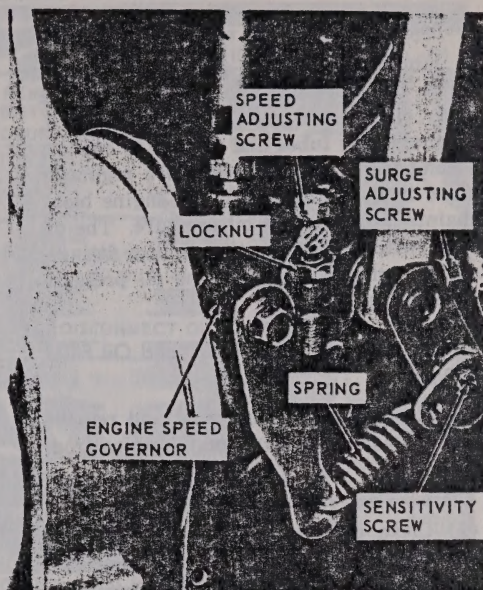
- (1) Clean the governor control rod with an approved cleaning solvent and dry thoroughly.
- (2) Inspect for damage and defects.
- (3) Replace all parts that are excessively damaged, worn, or defective.

c. Adjustment. Refer to figure 19 and adjust the governor control rod.

d. Installation. Refer to figure 19 and install the governor control rod on the engine.

89. Engine Speed Governor Adjustment

Refer to figure 20 and adjust the engine speed governor.



- STEP 1. ADJUST CARBURETOR (PAR. 74) AND GOVERNOR CONTROL ROD (PAR. 88).
- STEP 2. START ENGINE AND BRING UP TO OPERATING TEMPERATURE (TM 5-6115-244-10).
- STEP 3. OPERATE ENGINE AT 1,800 RPM WITHOUT A LOAD. LOOSEN LOCKNUT ON SPEED ADJUSTING SCREW AND ADJUST SCREW TO INCREASE ENGINE SPEED TO 1,950 RPM.
- STEP 4. APPLY A LOAD TO ENGINE AND ADJUST SPEED ADJUSTING SCREW TO MAINTAIN ENGINE SPEED AT 1,800 RPM. TIGHTEN LOCKNUT.
- STEP 5. REMOVE LOAD FROM ENGINE AND NOTE DIFFERENCE BETWEEN ENGINE SPEED WITH LOAD AND WITHOUT LOAD. DIFFERENCE SHOULD BE APPROXIMATELY 75 RPM.
- STEP 6. TO ADJUST DIFFERENCE BETWEEN ENGINE SPEED WITH LOAD AND WITHOUT LOAD, LOOSEN NUT ON SENSITIVITY SCREW AND ADJUST SCREW IN ITS SLOT UNTIL DIFFERENCE IS APPROXIMATELY 75 RPM. TIGHTEN NUT.
- STEP 7. APPLY A LOAD TO ENGINE AND OPERATE AT 1,800 RPM. IF ENGINE SURGES, LOOSEN LOCKNUT ON SURGE ADJUSTING SCREW AND TURN CLOCKWISE OR COUNTERCLOCKWISE UNTIL SURGING STOPS.

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Figure 20. Engine speed governor, adjustment.

Section VIII. LUBRICATION SYSTEM

90. General

The lubrication system consists of an oil filler pipe, cartridge-type oil filter, oil pressure regulator, oil pressure gage, oil pressure switch, and the necessary tubes and fittings to connect these components. The oil pressure regulator is located in the right side of the engine block and maintains a constant oil pressure. The oil pressure switch located on the oil filter fittings, shuts the engine down when the oil pressure drops below 7 pounds.

91. Oil Level Gage, Oil Fill Cap, and Oil Filler Pipe

a. Removal. Refer to figure 21 and remove the oil level gage, oil fill cap, and filler pipe from the engine.

b. Cleaning and Inspection.

- (1) Clean the oil level gage, oil fill cap, and oil filler pipe with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the oil level gage and oil fill cap for bends, cracks, and other damage. Inspect the filler pipe for damaged threads, cracks, and other damage. Replace damaged or defective parts.

c. Installation. Refer to figure 21 and install the oil level gage and filler pipe on the engine.

92. Oil Pressure Switch

a. Removal. Refer to figure 21 and remove the oil pressure switch from the oil filter fittings.

b. Cleaning and Inspection.

- (1) Clean the oil pressure switch using a cloth dampened with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the oil pressure switch for dents, cracks, loose connections, and other damage. Test the switch as outlined in *c* below. Replace a damaged or defective switch.

c. Testing. Test the oil pressure switch as follows:

- (1) Connect the oil pressure switch to a gage equipped source of air pressure

which can be varied above or below 7 pounds.

- (2) Connect a low-voltage test clamp circuit to the terminals of the switch. With no pressure on the switch the test lamp should light.
- (3) Slowly increase the pressure on the switch. As the pressure reaches 7 pounds, the lamp should go out and should remain out as the pressure raises above 7 pounds.

Caution: Do not allow the pressure to exceed 30 pounds.

- (4) Replace a defective oil pressure switch.

d. Installation. Refer to figure 21 and install the oil pressure switch on the oil filter fittings.

93. Oil Filter and Oil Filter Mounting Bracket

a. Removal.

- (1) Remove the oil pressure switch (par. 92).
- (2) Refer to figure 21 and remove the oil filter and oil filter mounting bracket from the engine.

b. Disassembly. Refer to figure 22 and disassemble the oil filter.

c. Cleaning and Inspection.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the oil filter body and cover for dents, cracks, defective threads, and other damage. Inspect the spring for cracks, fatigue, and other damage. Inspect the fittings and mounting hardware for cracks, breaks, damaged threads, and other damage. Inspect the gaskets, seals, and element for damage.
- (3) Replace all excessively damaged, worn, or defective parts.

d. Reassembly. Refer to figure 22 and reassemble the oil filter.

e. Installation.

- (1) Refer to figure 21 and install the oil filter and oil filter mounting bracket on the engine.

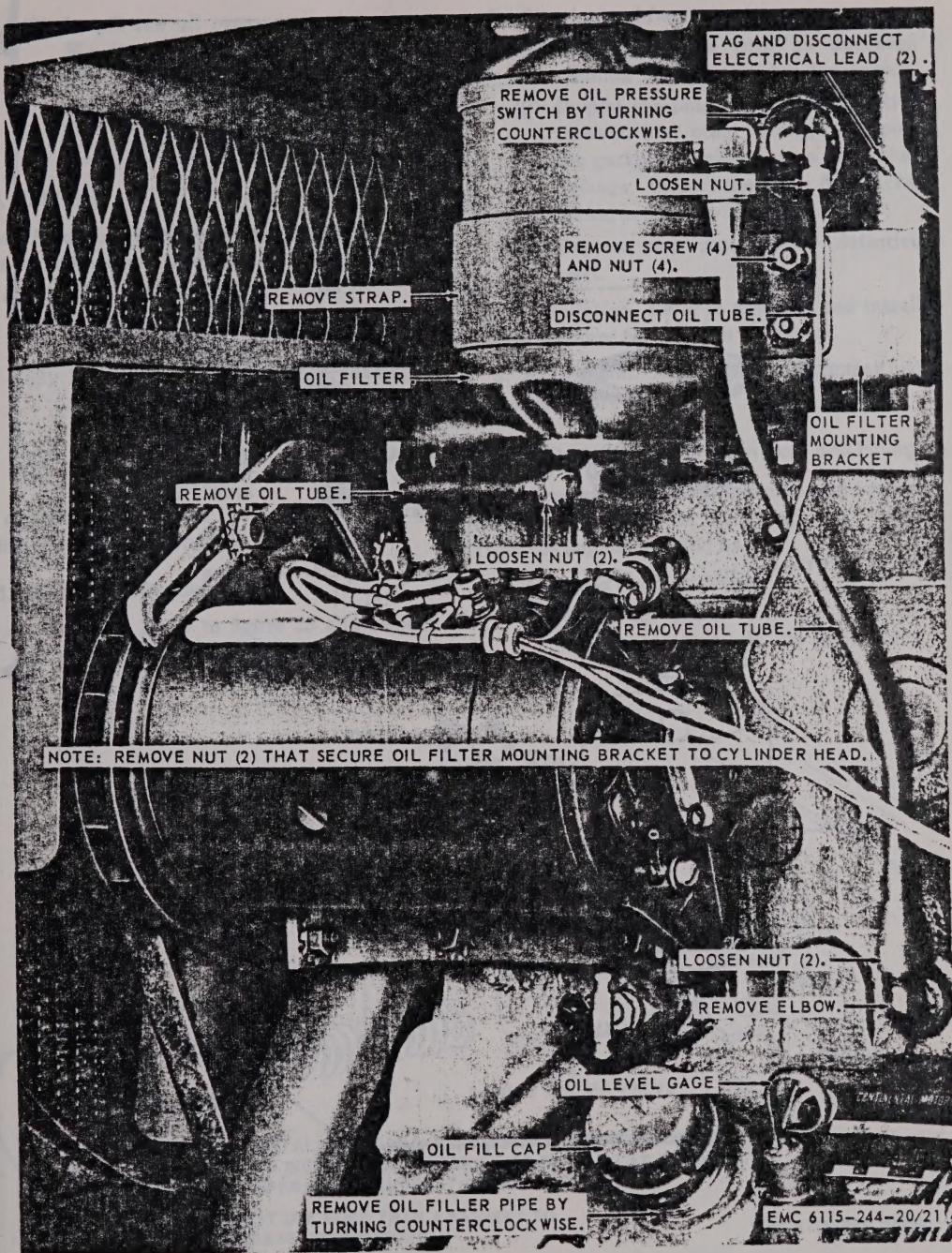
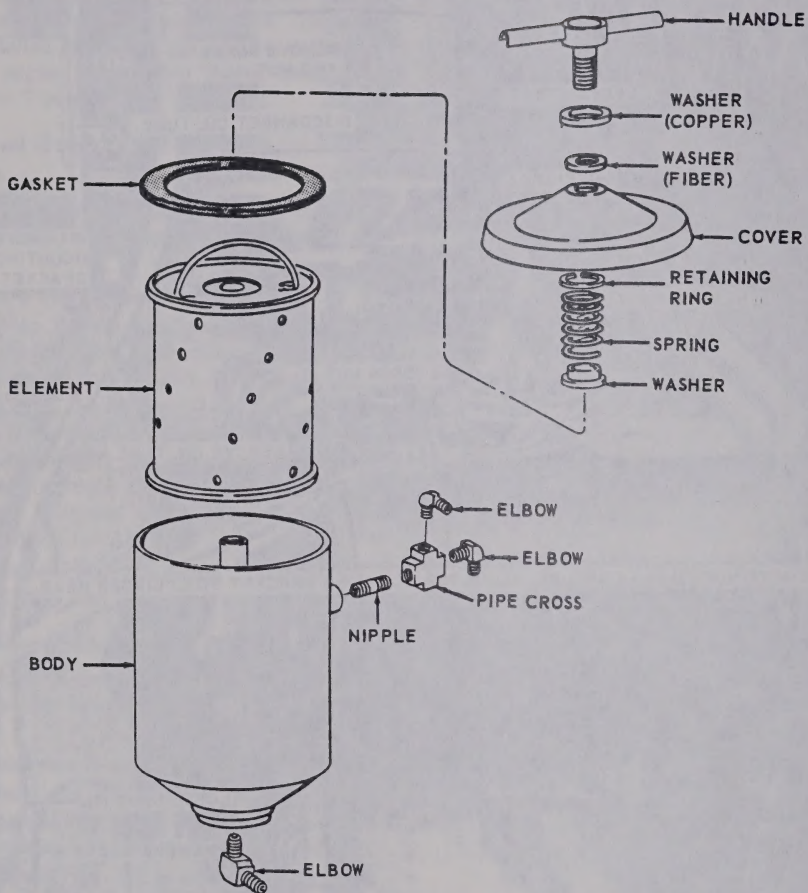


Figure 21. Oil level gage, oil fill cap, oil filler pipe, oil pressure switch, oil filter, oil filter mounting bracket, and oil tubes, removal and installation.



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Figure 22. Oil filter, disassembly and reassembly.

- (2) Install the oil pressure switch (par. 92).
- (3) Operate the engine for 5 to 10 minutes. Refer to the current lubrication order and fill the crankcase to the proper level.

94. Oil Tubes

a. Removal. Refer to figure 21 and remove the oil tubes from the engine.

b. Cleaning and Inspection.

- (1) Clean the oil tubes with an approved cleaning solvent and dry thoroughly.
- (2) Inspect for dents, cracks, damaged threads, obstructions in passages, and other damage.
- (3) Replace all damaged or defective oil tubes.

c. Installation. Refer to figure 21 and install the oil tubes on the engine.

95. Oil Pressure Regulator

a. Removal. Refer to figure 23 and remove oil pressure regulator from the engine.

b. Cleaning and Inspection.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the plug for cracks, defective threads, and other damage. Inspect the gasket for breaks, tears, and other damage. Inspect the valve for cracks, nicks, and other damage.
- (3) Replace any damaged or defective part.

c. Installation. Refer to figure 23 and install the oil pressure regulator in the engine.

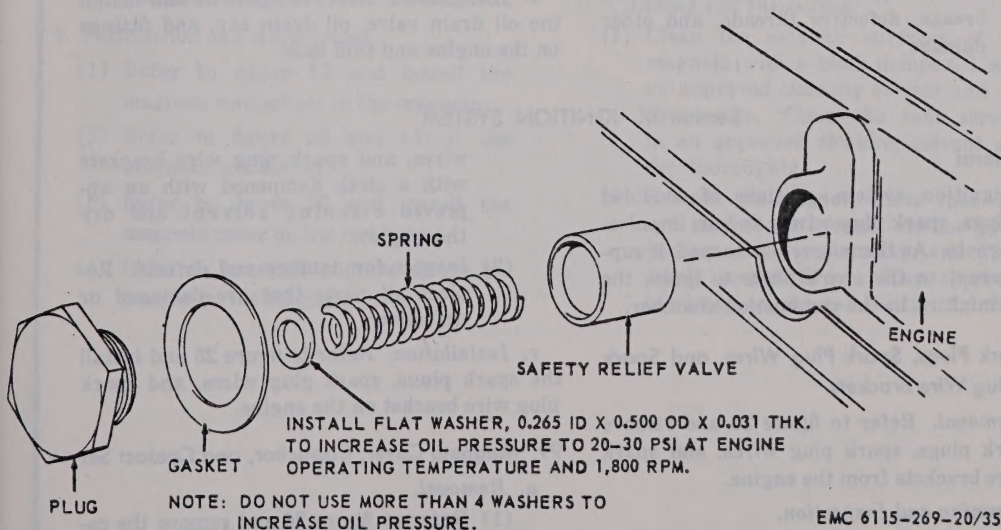
d. Adjustment. Refer to figure 23 and adjust the oil pressure regulator.

96. Oil Drain Valve, Oil Drain Cap, and Fittings

a. Removal. Refer to figure 24 and remove the oil drain valve, oil drain cap, and fittings from the engine and skid base.

b. Cleaning and Inspection.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.



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Figure 23. Oil pressure regulator, removal, installation, and adjustment.

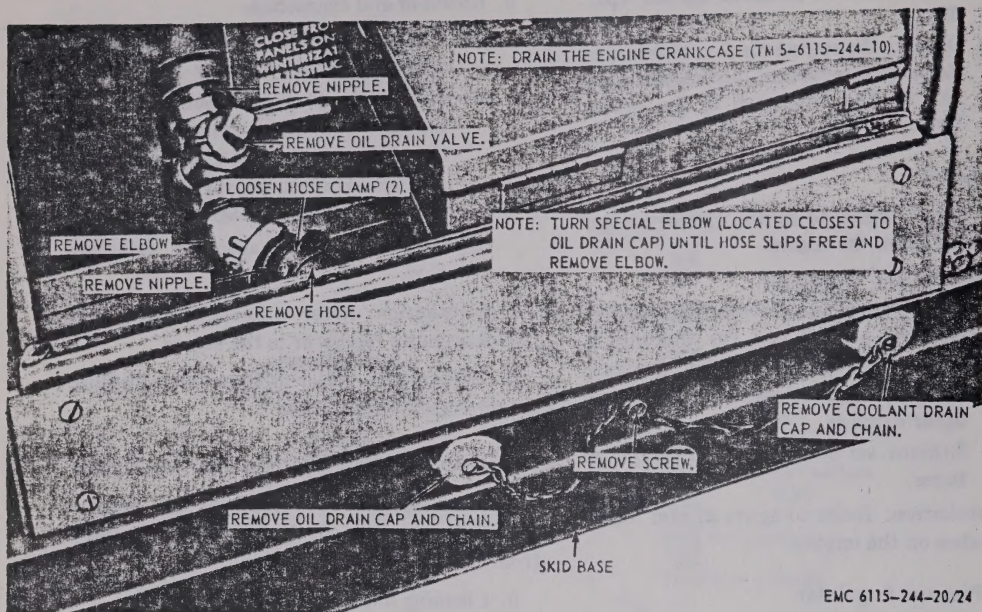


Figure 24. Oil drain valve, oil drain cap, and fittings, removal and installation.

- (2) Inspect the hose for breaks, cracks, tears, and other damage. Inspect the valve, cap, and fittings for cracks, breaks, defective threads, and other damage.

- (3) Replace any damaged or defective part.

c. Installation. Refer to figure 24 and install the oil drain valve, oil drain cap, and fittings on the engine and skid base.

Section IX. IGNITION SYSTEM

97. General

The ignition system consists of shielded spark plugs, spark plug wires, and an impulse-type magneto. As the magneto is turned, it supplies current to the spark plugs to ignite the fuel-air mixture in the combustion chamber.

98. Spark Plugs, Spark Plug Wires, and Spark Plug Wire Brackets

a. Removal. Refer to figure 25 and remove the spark plugs, spark plug wires, and spark plug wire brackets from the engine.

b. Cleaning and Inspection.

- (1) Clean the spark plugs, spark plug

wires, and spark plug wire brackets with a cloth dampened with an approved cleaning solvent and dry thoroughly.

- (2) Inspect for damage and defects. Replace all parts that are damaged or defective.

c. Installation. Refer to figure 25 and install the spark plugs, spark plug wires, and spark plug wire bracket on the engine.

99. Magneto Cover, Capacitor, and Contact Set

a. Removal.

- (1) Refer to figure 26 and remove the capacitor from the magneto cover.

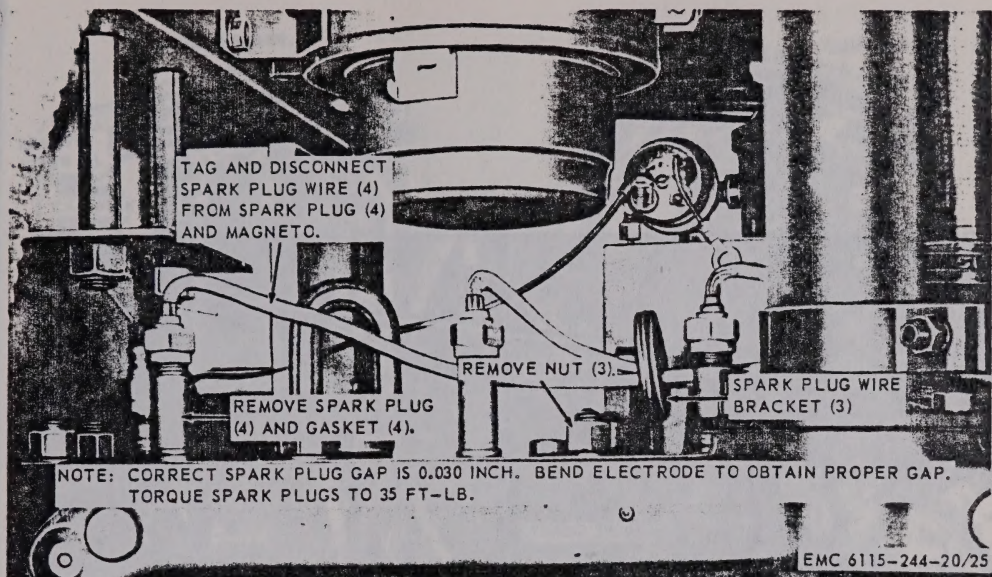


Figure 25. Spark plugs, spark plug wires, and spark plug wire brackets, removal and installation.

- (2) Refer to figure 26 and remove the magneto cover from the magneto.
- (3) Refer to figure 27 and remove the magneto contact set from the magneto.

b. Installation and Adjustment.

- (1) Refer to figure 27 and install the magneto contact set in the magneto.
- (2) Refer to figure 28 and adjust the magneto contact set.
- (3) Refer to figure 26 and install the magneto cover on the magneto.
- (4) Refer to figure 26 and install the capacitor on the magneto cover.

100. Magneto

a. Removal. Refer to figure 26 and remove the magneto from the engine.

b. Cleaning and Inspection.

- (1) Clean the exterior surfaces of the magneto with a cloth dampened with an approved cleaning solvent and dry thoroughly. Clean the vent screens in an approved cleaning solvent and dry thoroughly.
- (2) Remove the magneto cover (par. 99) and inspect the contact set for pyramiding, excessive burning, and wear. Apply several drops of an approved lubricant to the cam wick (fig. 27).

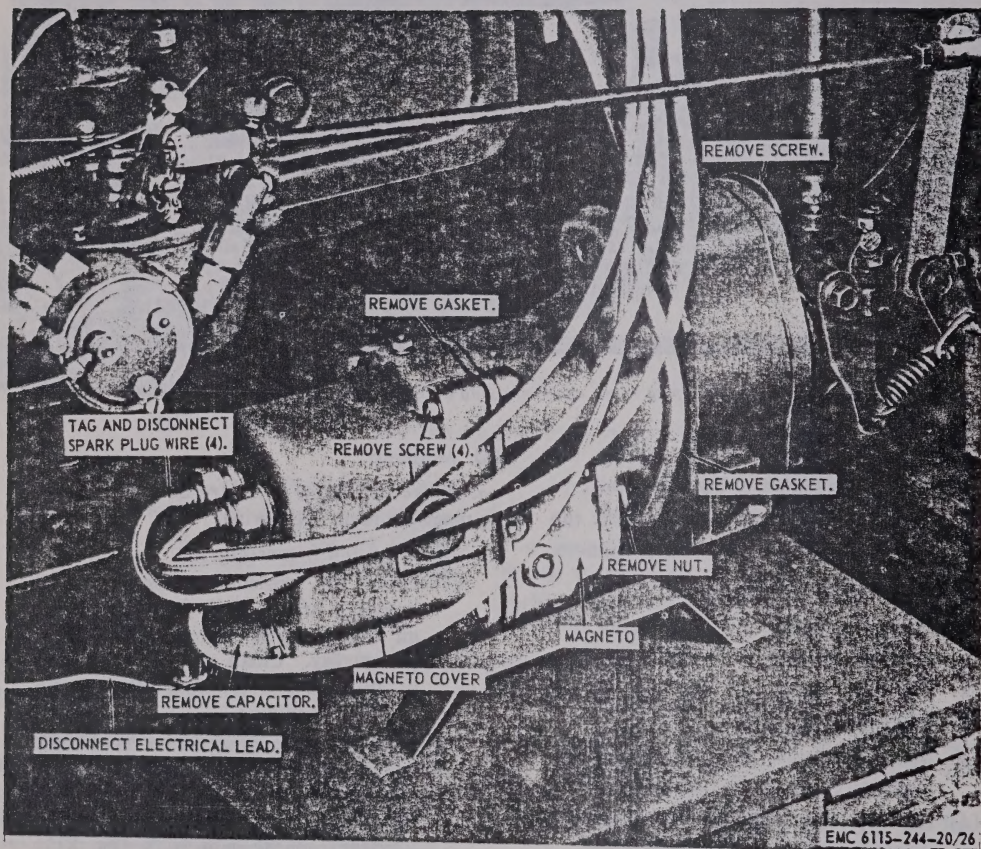
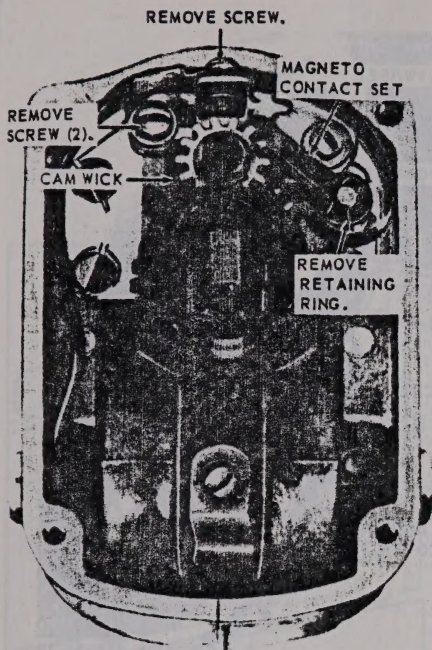


Figure 26. Magneto, magneto cover, and capacitor, removal, and installation.



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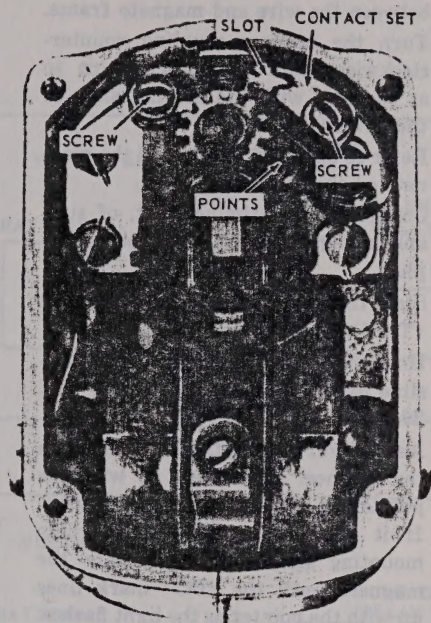
Figure 27. Magneto contact set, removal and installation.

Replace the contact set if the points are excessively worn or pitted.

- (3) Inspect the interior parts of the magneto for damage and defects. Inspect the body of the magneto for cracks, breaks, damaged threads, and missing parts. Replace a damaged or defective magneto.

c. Installation and Timing.

- (1) Remove the rear (number four) spark plug (par. 98).
- (2) Turn the engine over, with the thumb over the rear spark plug hole, until air is exhausting on the compression stroke.
- (3) Continue to turn the engine until the "DC" mark on the flywheel lines up with the pointer in the timing hole opening as shown by figure 29.



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Figure 28. Magneto contact set, adjustment.

- STEP 1. ROTATE ENGINE UNTIL POINTS OF CONTACT SET ARE AT FULL SEPARATION.
- STEP 2. MEASURE GAP BETWEEN POINTS USING A 0.015-INCH FEELER GAGE.
- STEP 3. LOOSEN SCREW (2).
- STEP 4. INSERT SCREWDRIVER IN SLOT AND ROTATE CLOCKWISE OR COUNTER-CLOCKWISE UNTIL GAP BETWEEN POINTS IS 0.015 INCH.
- STEP 5. TIGHTEN SCREW (2).

- (4) Install the number four spark plug (par. 98).
- (5) Set the magneto by inserting a short, stiff piece of insulated wire into the number four socket and bend the other end of the wire to within one-quarter inch of the magneto frame.

- (6) Turn the impulse coupling in a clockwise direction until a spark is observed between the wire and magneto frame.
- (7) Turn the impulse coupling counterclockwise about one-quarter turn so as to mesh with the driving slots of the governor gear.
- (8) Refer to figure 26 and install the magneto on the engine.
- (9) Connect a neon timing light, of suitable voltage, to the number four spark plug.
- (10) Start the engine and run at idle speed (TM 5-6115-244-10).
- (11) Hold the timing light as close as possible to the timing hole opening (fig. 29).
- (12) As the light flashes, the "DC" mark on the flywheel should line up with the pointer in the timing hole opening. If it does not, loosen the magneto mounting hardware and rotate the magneto until the "DC" mark lines up with the pointer as the light flashes. Tighten the magneto mounting hardware.

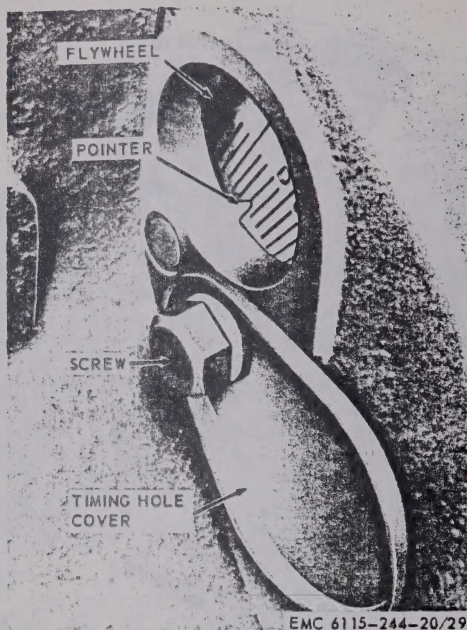


Figure 29. Timing marks.

Section X. ENGINE ELECTRICAL SYSTEM

101. General

The 24-volt engine electrical system consists of an engine generator, engine generator regulator, starter, solenoid relay, solenoid switch, two 12-volt batteries, and the necessary wiring to connect these components. Refer to figure 2 for the practical wiring diagram.

Warning: Do not perform maintenance on the electrical system while the generator set is operating.

102. Solenoid Relay

- a. *On-Unit Testing.* Refer to figure 30 and test the starter and solenoid relay.
- b. *Removal.* Refer to figure 31 and remove the solenoid relay from the starter.
- c. *Cleaning and Inspection.*
 - (1) Clean the solenoid relay and linkage

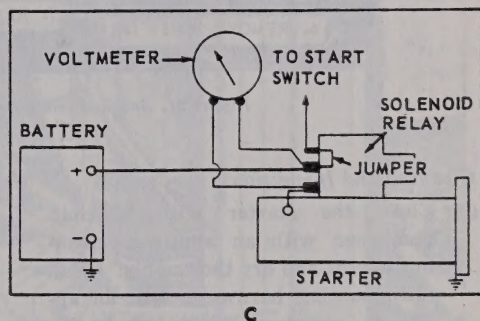
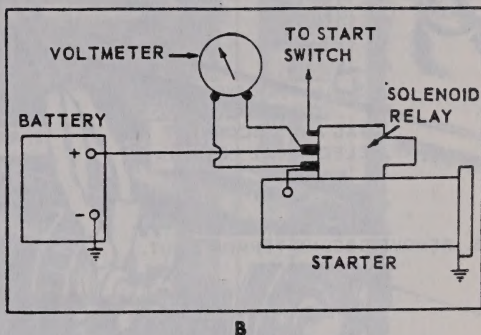
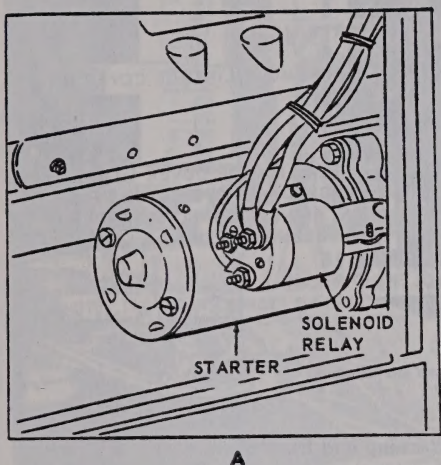
with a cloth dampened with an approved cleaning solvent and dry thoroughly.

- (2) Inspect the solenoid relay for dents, cracks, loose terminals, defective insulation, and other damage. Inspect the linkage for bends, cracks, and other damage.
- (3) Replace a defective solenoid relay or defective or damaged linkage.

d. *Installation.* Refer to figure 31 and install the solenoid relay on the starter.

103. Starter

- a. *On-Unit Testing.* Refer to paragraph 102.
- b. *Removal.*
 - (1) Refer to figure 32 and remove the starter from the engine.
 - (2) Remove the solenoid relay (par. 102).



- STEP 1. DETERMINE THAT BATTERIES ARE FULLY CHARGED AND THAT ALL BATTERY AND STARTER CABLES ARE SERVICEABLE AND PROPERLY INSTALLED.**
- STEP 2. CONNECT VOLTMETER AS SHOWN IN B ABOVE. IF BATTERY VOLTAGE (24 VOLTS) IS NOT INDICATED, THE STARTER IS DEFECTIVE AND MUST BE REPLACED.**
- STEP 3. MOMENTARILY CONNECT A JUMPER AS SHOWN IN C ABOVE. THE VOLTMETER READING SHOULD DROP TO ZERO AND STARTER SHOULD CRANK ENGINE. IF VOLTMETER READING DOES NOT DROP TO ZERO, SOLENOID RELAY IS DEFECTIVE AND MUST BE REPLACED. IF VOLTMETER READING DROPS TO ZERO BUT STARTER FAILS TO CRANK ENGINE, STARTER IS DEFECTIVE AND MUST BE REPLACED.**

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Figure 30. Starter and solenoid relay, on-unit testing.

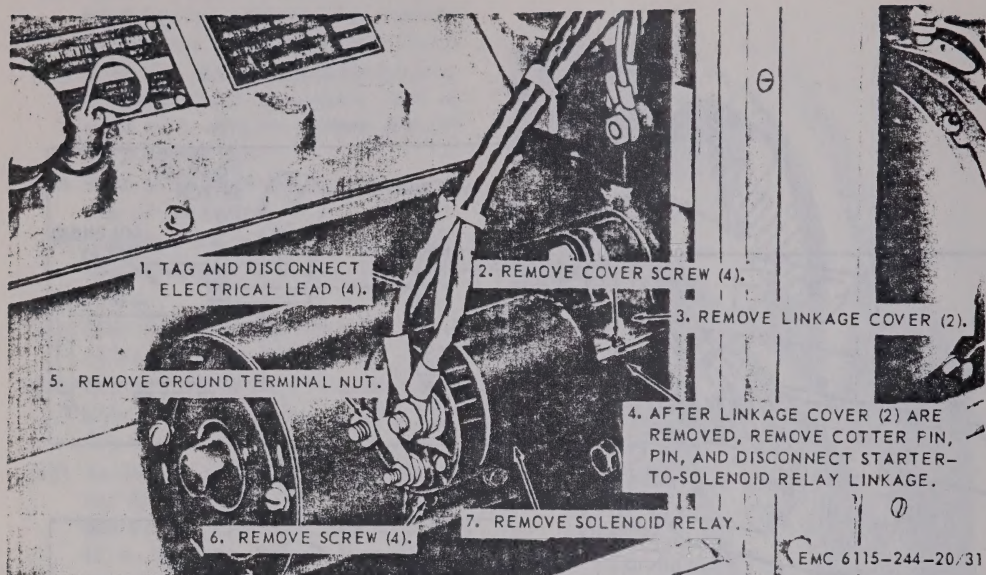


Figure 31. Solenoid relay, removal and installation.

c. Cleaning and Inspection.

- (1) Clean the starter with a cloth dampened with an approved cleaning solvent and dry thoroughly. Clean the mounting hardware with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the starter for dents, cracks, loose terminals, defective insulation, and other damage. Inspect the mounting hardware for bends, cracks, defective threads, and other damage.
- (3) Replace all parts that are excessively damaged, worn, or defective.

d. Installation.

- (1) Install the solenoid relay (par. 102).
- (2) Refer to figure 32 and install the starter on the engine.

104. Solenoid Switch

a. Removal. Refer to figure 32 and remove the solenoid switch from the lifting frame.

b. Cleaning and Inspection.

- (1) Clean the solenoid switch with a cloth dampened with an approved cleaning solvent and dry thoroughly. Clean the mounting hardware with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the solenoid switch for dents, cracks, loose terminals, and other damage. Inspect the mounting hardware for bends, cracks, defective threads, and other damage.
- (3) Replace a damaged or defective solenoid switch on the lifting frame.

c. Installation. Refer to figure 32 and install the solenoid switch on the lifting frame.

105. Engine Generator

a. On-Unit Testing. Defects in the engine battery-charging system are indicated by a high-charging rate when the batteries are fully charged, or by a low- or no-charging rate when the batteries are low. Test the engine genera-

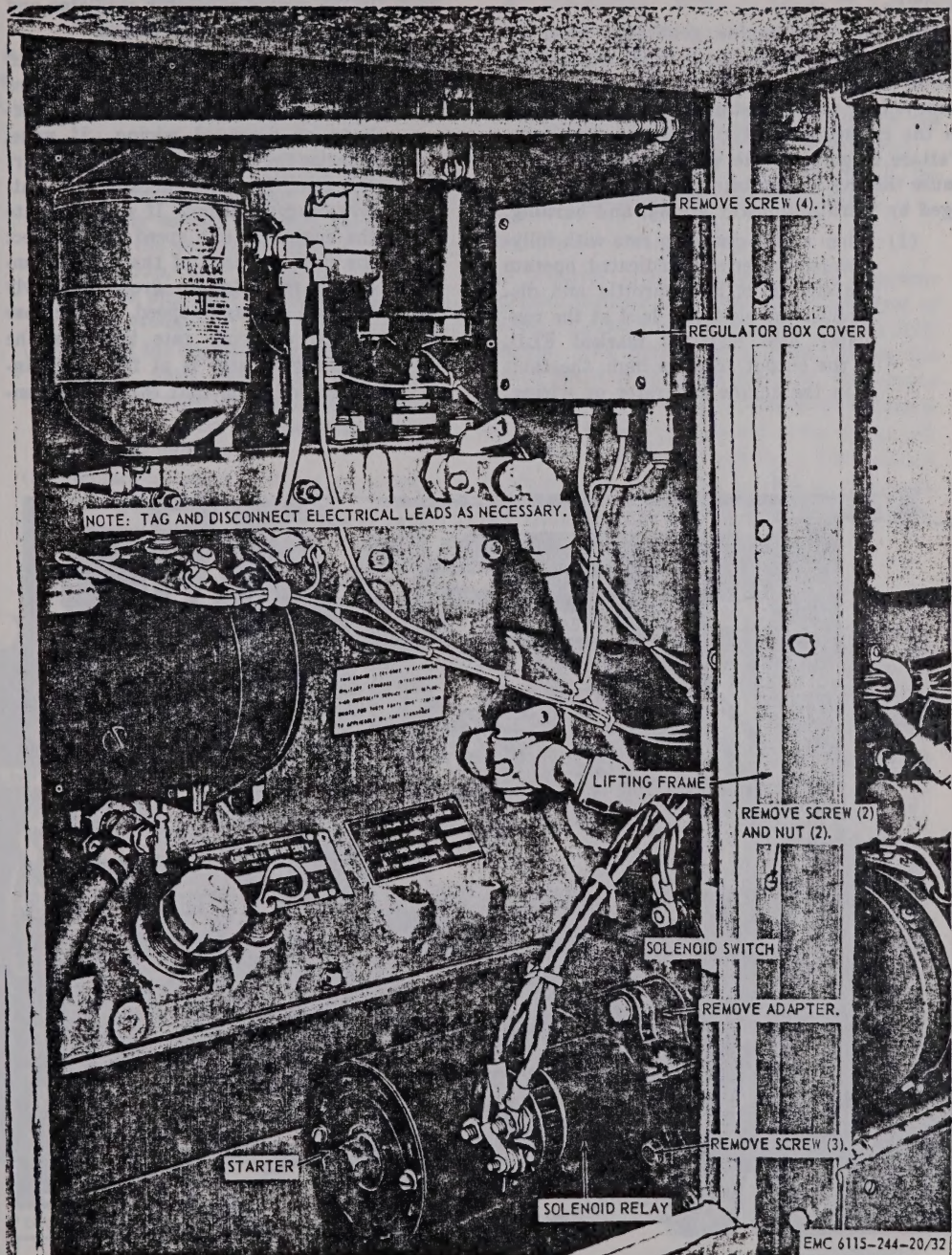


Figure 32. Starter, solenoid switch, and regulator box cover, removal and installation.

tor and engine generator regulator as instructed below:

Caution: The engine generator must be polarized whenever the leads to the engine generator or engine generator regulator have been removed or any adjustments have been made to the engine generator or engine regulator. Failure to polarize the engine generator may cause the engine regulator contacts to be damaged by vibration, heavy arcing, and burning.

- (1) When a high-charging rate with fully-charged batteries is indicated, operate the engine at half throttle and disconnect the electrical lead at the regulator field terminal marked FLD. If the output remains high, the fault is in the engine generator or wiring.

If the output drops off, the trouble is in the engine generator regulator and must be adjusted or replaced.

- (2) When a low- or no-charging rate with partially or fully discharged batteries is indicated, inspect for loose connections or damaged wiring. If none, polarize the engine generator and start the generator set, checking for battery-charger output. If none, operate the engine at idle speed and connect the field terminal of the engine generator regulator to ground. Slowly increase the engine speed. No increase in the charging rate indicates the engine generator is at fault. An increase indicates that the engine gen-

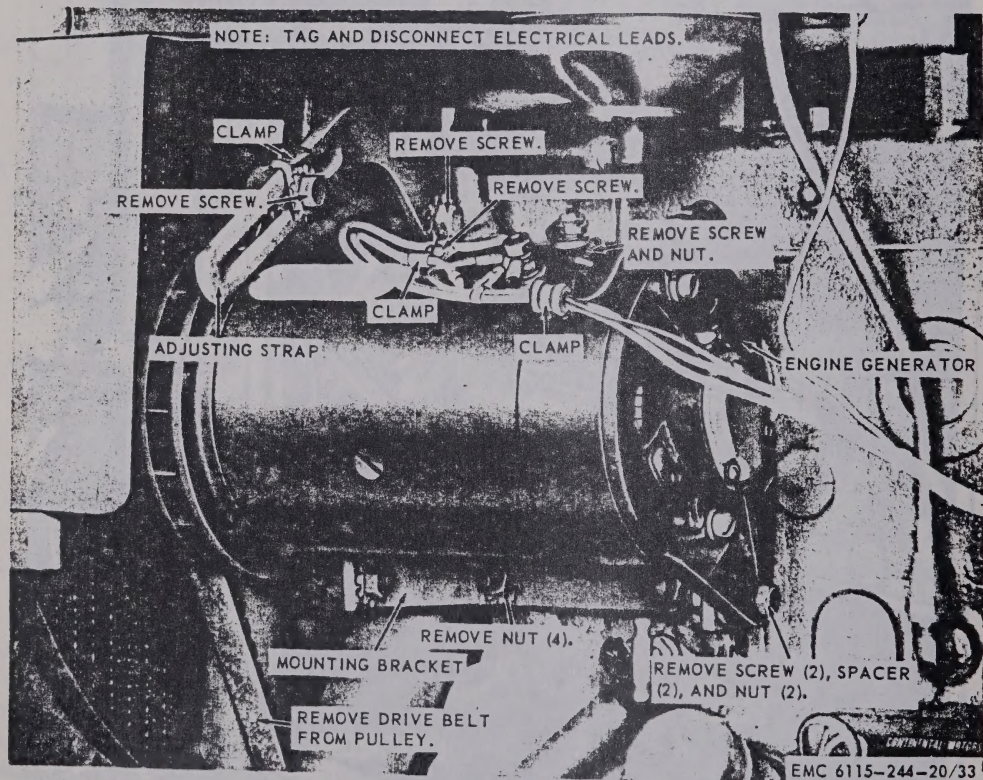


Figure 33. Engine generator, mounting bracket, and adjusting strap, removal and installation.

erator regulator is at fault and must be adjusted or replaced.

b. *Removal.* Refer to figure 33 and remove the engine generator, mounting bracket, and adjusting strap from the engine.

c. *Cleaning and Inspection.*

- (1) Clean the engine generator with a cloth dampened with an approved cleaning solvent and dry thoroughly. Clean the mounting bracket, adjusting strap, and mounting hardware with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the engine generator for dents, cracks, loose terminals, and other damage. Inspect the mounting bracket, adjusting strap, and mounting hardware for damage.
- (3) Replace all parts that are excessively damaged, worn, or defective.

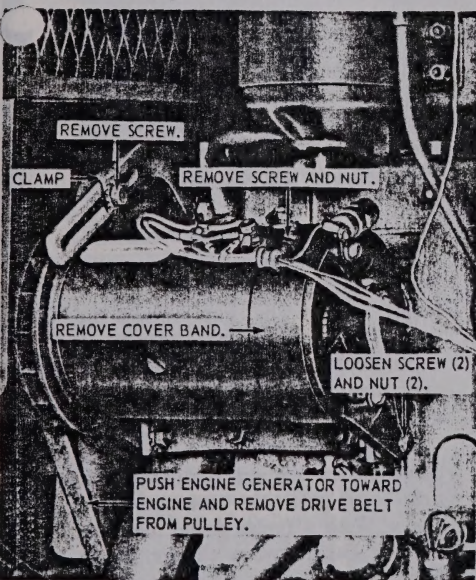
d. *Installation.* Refer to figure 33 and install the engine generator, mounting bracket, and adjusting strap on the engine.

e. *Brushes.*

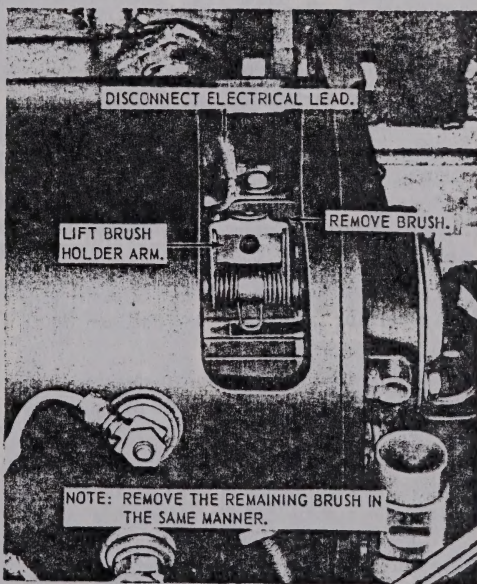
- (1) Refer to figure 34 and remove the brushes from the engine generator.
- (2) Refer to figure 34 and install the brushes in the engine generator.

106. Engine Generator Regulator

a. *General.* The three-unit engine generator regulator automatically controls the output of the engine generator to keep the batteries fully charged. The circuit breaker unit closes the circuit between the batteries and the engine generator when the engine generator voltage is above the battery voltage and opens the circuit when the condition is reversed. The current regulator unit limits the current to the maximum rated value of the engine generator and



A. COVER BAND.



B. BRUSHES.

Figure 34. Engine generator brushes, removal and installation.

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the engine generator regulator unit maintains the voltage of the system at the full-charge level.

b. *On-Unit Testing.* Refer to paragraph 105.

c. *Removal.*

- (1) Refer to figure 32 and remove the regulator box cover from the regulator box.
- (2) Refer to figure 35 and remove the engine generator regulator and regulator box from the generator set.

d. *Cleaning and Inspection.*

- (1) Clean the engine generator regulator with a dry, lint-free cloth. Clean the engine generator regulator cover, regulator box, and regulator box cover with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the base and cover for cracks, dents, and loose or broken terminals. Replace a damaged or defective engine generator regulator.
- (3) Examine the screws and nuts for damaged threads. Replace defective parts.
- (4) Examine the coils, resistors, and insulation for evidence of burning.
- (5) Inspect the surface of the contacts. In normal use, they will appear grayed. Clean dirty contacts with a strip of linen tape dampened in an approved cleaning solvent. Dress burned or pitted contacts with a point file.

e. *Testing and Adjustment.* Test and adjust the engine generator regulator as outlined below:

- (1) *Continuity test.* Use a multimeter to test the series and field circuits of the regulator.
 - (a) To test the series circuit, touch the test probes to the armature terminal and the circuit breaker armature. If the circuit is open, the regulator is defective and must be replaced. Hold the circuit breaker armature down and test between the armature terminals and the battery terminal. If the circuit is open,

clean and file the circuit breaker contacts. Test again and, if the circuit is still open, replace the regulator.

- (b) To test the field circuit, touch the test probes to the FLD terminal and the regulator base. The meter must show zero resistance. Open the contacts of the voltage regulator unit (fig. 36). The meter must show the resistance of the shunt resistor. If the circuits do not meet the above requirements, file and clean the voltage regulator unit and current regulator unit contacts and repeat the test. If still faulty, replace the regulator.
- (2) *Mechanical adjustment.* Mechanical adjustments must be made with the regulator off the unit and the batteries disconnected.
 - (a) *Circuit breaker air gap.* Press down on the circuit breaker armature until the contacts just close. With a feeler gage, measure the air gap between the armature and the center core. The gap should be 0.034 to 0.040 inch. Adjust, if necessary, by loosening the one armature attaching screw and raising or lowering the armature. Tighten the screw and measure the gap after adjustment.
 - (b) *Circuit breaker contact gap.* Measure the gap between the contacts of the circuit breaker unit with a feeler gage. The gap should be 0.015 inch minimum. Adjust, if necessary, by bending the upper armature stop to give the proper gap.
 - (c) *Voltage regulator air gap.* Press down on the voltage regulator unit armature until the contacts just close. With a feeler gage, measure the air gap between the armature and the center core. The gap should be 0.048 to 0.052 inch. Adjust, if necessary, by loosening the one upper contact support attaching screw and raising or lowering the sup-

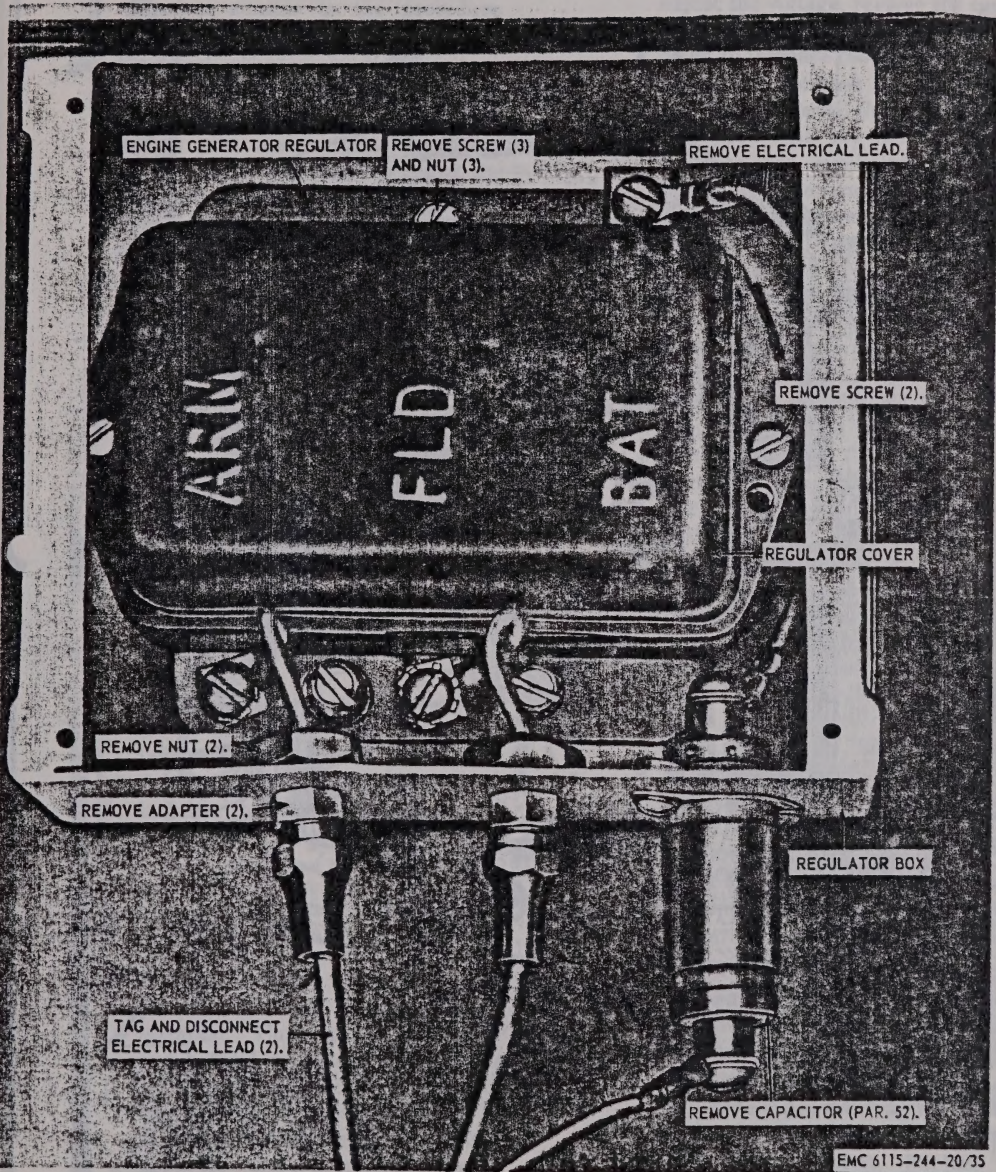
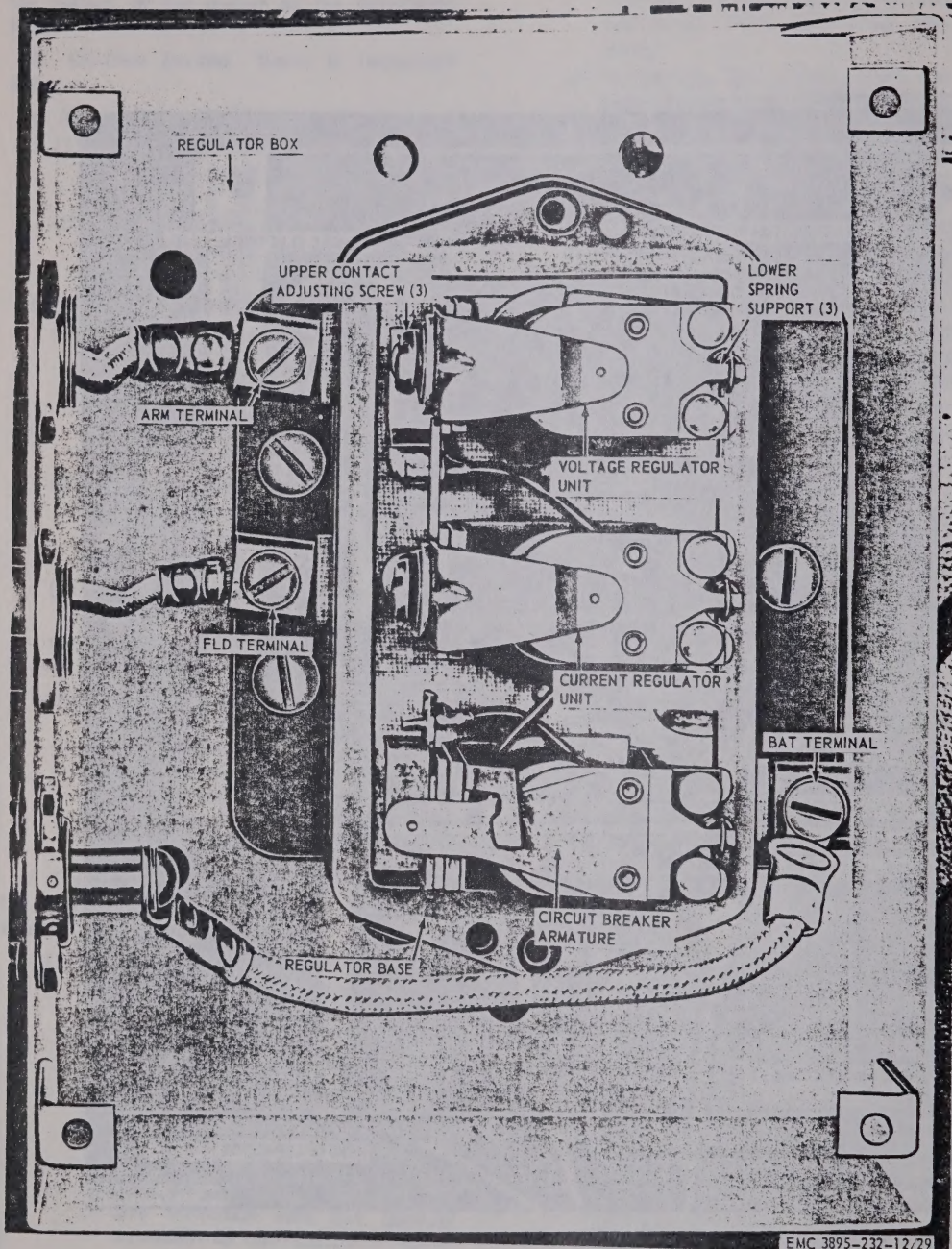


Figure 35. Engine generator regulator, regulator cover, and regulator box, removal and installation.



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Figure 36. Engine generator regulator, adjustment.

port. Tighten the screw and measure the gap after adjustment.

- (d) *Current regulator air gap.* The correct current regulator unit air gap is 0.048 to 0.052 inch. Adjust in a manner similar to the procedure outlined in (c) above.
- (3) *Electrical adjustment.* A low-voltage test set including a voltmeter, ammeter, fixed and variable resistors, a carbon pile, and suitable switching devices should be used to make the electrical adjustments on the regulator. Mount the regulator in operating position on or near the unit.

Caution: The circuit breaker contacts must not be closed by hand with the batteries connected. The resultant high current will damage the contacts.

- (a) *Circuit breaker unit.* Connect the ARM terminal and the FLD terminal to their respective terminals on the engine generator and connect the battery lead to the BAT terminal of the regulator. Polarize the engine generator by momentarily placing a jumper wire across the regulator terminals marked ARM and BAT. Connect a voltmeter between the regulator base and the ARM terminal. Start the engine and slowly increase the speed. The contacts should close at 25 volts. Bend down the lower spring support to increase the closing voltage and up to decrease it. Stop the engine.

Note. In this and the following procedures, the generator frame, the regulator base, and the battery ground terminal must be connected to each other or a common ground.

- (b) *Voltage regulator unit.* Disconnect the battery lead from the BAT terminal. Connect the voltmeter and a fixed resistance between the BAT terminal and the regulator base. The fixed resistance should be 7 ohms and must be capable of carrying 10 amperes without change of resistance. Install the regulator cover and operate the engine at

operating speed for 15 minutes to bring the regulator to operating temperature. The voltmeter should indicate 28.3 volts at a surrounding temperature of 80° Fahrenheit. To adjust the voltage, remove the cover and bend the lower spring support down to increase the voltage setting and up to decrease it. After each adjustment, install the cover, reduce the speed until the circuit breaker contacts open, and bring the engine slowly up to operating speed. Repeat this procedure until the voltage setting remains constant. Stop the engine and disconnect the fixed resistance and the voltmeter.

- (c) *Current regulator unit.* Connect the carbon pile across the battery. Remove the electrical lead from the regulator terminal marked BAT. Connect one lead of the test ammeter to the BAT terminal of the regulator and the other lead to the wire that was removed from the BAT terminal. Polarize the engine generator momentarily, connecting the BAT and ARM terminals of the regulator by using a jumper wire. Warm up the regulator for 15 minutes as instructed in (a) above. Remove the regulator cover and drive the generator at operating speed. Manually close the current regulator contacts and adjust the carbon pile to cause the test ammeter to read 6 amperes. Release the contacts and bend down the lower spring support to increase the current setting and up to decrease it, until the test ammeter indicates 4.8 to 5.2 amperes.
- (d) *Testing after adjustment.* Install the cover on the regulator and test the operation of all three units at operating temperature. Repeat the adjustment procedures, (a) and (b) above as necessary, until the settings cease to drift. Replace the regulator if it fails to respond to the adjustment procedures.

f. Installation.

- (1) Refer to figure 35 and install the regulator cover, engine generator regulator, and regulator box on the generator set.
- (2) Refer to figure 32 and install the regulator box cover on the regulator box.

Caution: The engine generator must be polarized whenever the leads to the engine generator or engine generator regulator have been removed or adjustments have been made to the engine generator or regulator. Failure to polarize the generator may cause the regulator contacts to be damaged by vibration, heavy arcing, and burning.

107. Generator Drive Belt

a. Removal. Refer to figure 37 and remove the generator drive belt from the pulleys.

b. Cleaning and Inspection.

- (1) Clean the belt with a clean, dry cloth.
- (2) Inspect the belt for a cracked, frayed, or oil-soaked condition. Replace a defective belt.

c. Installation. Refer to figure 37 and install the generator drive belt on the pulleys.

d. Adjustment. Refer to TM 5-6115-244-10.

108. Battery Box

a. Removal.

- (1) Remove the batteries (TM 5-6115-244-10).
- (2) Refer to figure 38 and remove the battery box from the generator set.

b. Disassembly. Refer to figure 39 and disassemble the battery box.

c. Cleaning and Inspection.

- (1) Clean all parts of the battery box with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the battery box and lid for dents, breaks, cracks, distortion, and other damage. Inspect the heating element for cracks, breaks, and other damage. Inspect the thermostats for loose connections and other damage. Inspect the wooden blocks and mounting hardware for damage.
- (3) Replace all parts that are excessively damaged, worn, or defective.

d. Reassembly. Refer to figure 39 and reassemble the battery box.

e. Installation.

- (1) Refer to figure 38 and install the battery box on the generator set.
- (2) Install and service the batteries (TM 5-6115-244-10).

109. Battery Cables

a. Removal.

- (1) Disconnect the battery cables from the batteries (TM 5-6115-244-10).
- (2) Disconnect the positive battery cable from the starter solenoid and the negative battery cable from ground.

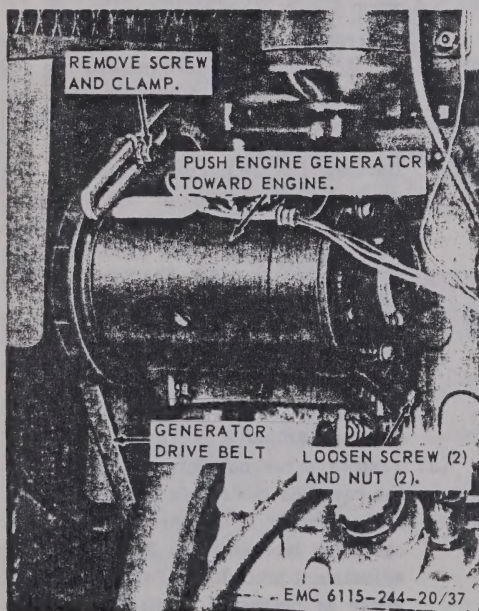
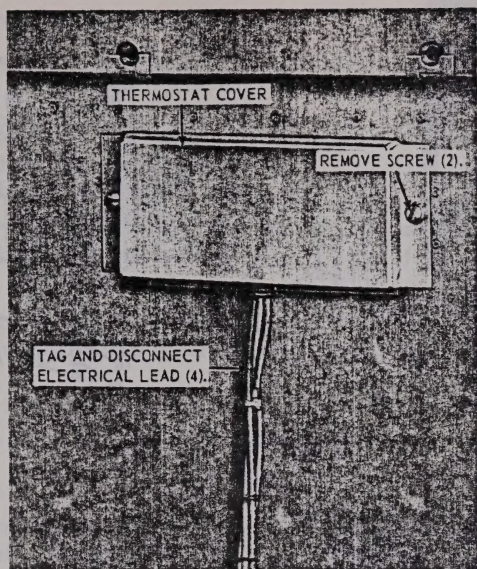
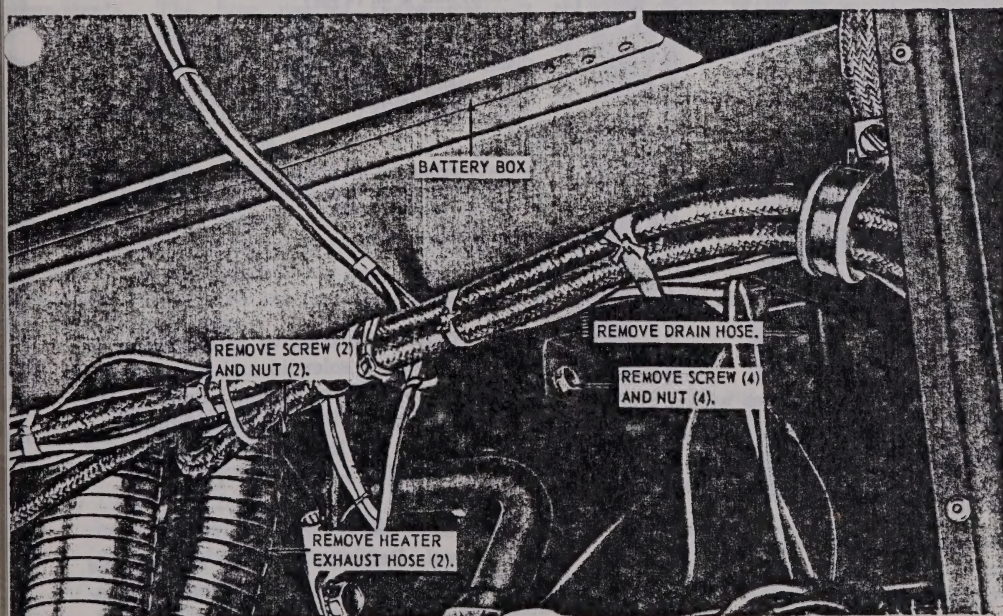


Figure 37. Generator drive belt, removal and installation.



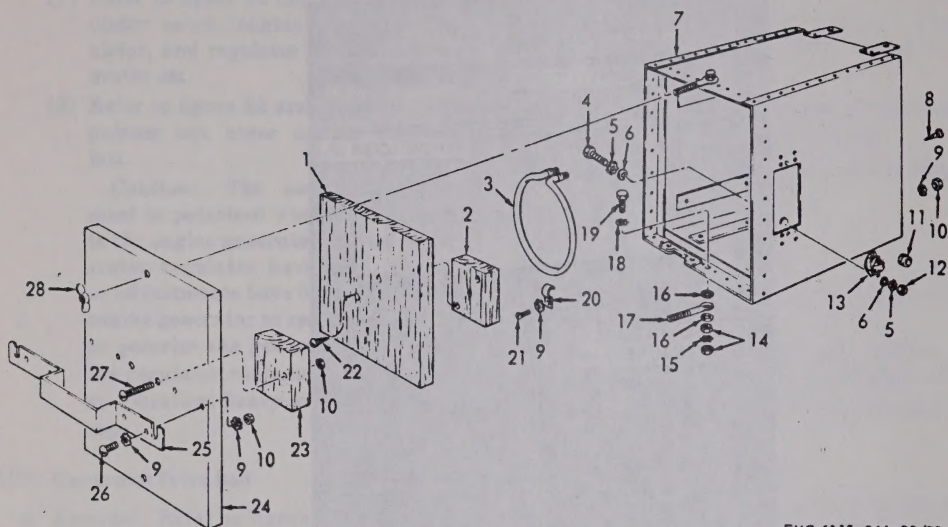
A. THERMOSTAT COVER.



B. BATTERY BOX AND HEATER EXHAUST HOSES.

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Figure 38. Battery box and heater exhaust hoses, removal and installation.



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- 1 Plywood
- 2 Block
- 3 Heater ring
- 4 Screw, machine, rd-hd, No. 6-32 x $\frac{1}{2}$ in. (4 rqr)
- 5 Washer, lock, ET, No. 6 (8 rqr)
- 6 Washer (spec) (8 rqr)
- 7 Battery box
- 8 Screw, wood, rd-hd, No. 10 x $1\frac{1}{2}$ in. (2 rqr)
- 9 Washer, lock, ET, No. 8 (14 rqr)
- 10 Nut, plain, hex, No. 8-32 (9 rqr)
- 11 Grommet
- 12 Nut, plain, hex, No. 6-32 (4 rqr)
- 13 Thermostat (2 rqr)
- 14 Nut, plain, hex, $\frac{1}{4}$ -20 (4 rqr)

- 15 Washer, lock, ET, $\frac{1}{4}$ in. (2 rqr)
- 16 Washer, flat, $\frac{1}{4}$ in. (4 rqr)
- 17 Eyebolt, $\frac{1}{4}$ -20 (2 rqr)
- 18 Washer, lock, IT, $\frac{1}{4}$ in. (2 rqr)
- 19 Screw, cap, hex-hd, $\frac{1}{4}$ -20 x 1 in. (2 rqr)
- 20 Clamp
- 21 Screw, machine, rd-hd, No. 8-32 x 1 in. (3 rqr)
- 22 Screw, wood, flat-hd, No. 10 x $1\frac{1}{2}$ in. (2 rqr)
- 23 Block
- 24 Lid
- 25 Handle
- 26 Screw, machine, rd-hd, No. 8-32 x $\frac{1}{2}$ in. (4 rqr)
- 27 Screw, machine, rd-hd, No. 8-32 x $2\frac{1}{4}$ in. (2 rqr)
- 28 Wingnut, $\frac{1}{4}$ -20 (2 rqr)

Figure 39. Battery box, disassembly and reassembly.

Refer to the practical wiring diagram, figure 2.

b. Cleaning and Inspection.

- (1) Clean the battery cables with a cloth dampened with an approved cleaning solvent and dry thoroughly. Clean any corrosion from the cable terminals.
- (2) Inspect the cables for cracks, breaks, and other damage. Replace a defective battery cable.

c. Installation.

- (1) Connect the positive battery cable to the starter solenoid and the negative battery cable to ground. Refer to the practical wiring diagram, figure 2.
- (2) Connect the battery cables to the batteries (TM 5-6115-244-10).

110. Battery-Charging Connector

a. *Removal.* Refer to figure 40 and remove the battery-charging connector from the generator set.

b. Cleaning and Inspection.

- (1) Clean the battery-charging connector and attached leads with a cloth dampened with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the connector for cracks, breaks, and other damage. Inspect the leads for broken or frayed insulation, breaks, and other damage.
- (3) Replace all parts that are excessively damaged, worn, or defective.

c. Installation. Refer to figure 40 and install the battery-charging connector on the generator set.

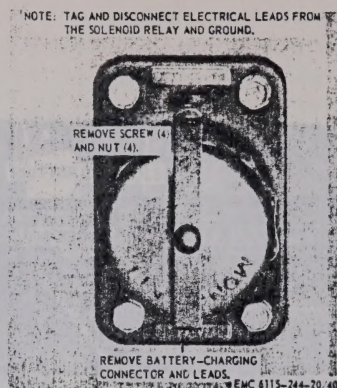


Figure 40. Battery-charging connector, removal and installation.

Section XI. COOLING SYSTEM

111. General

The cooling system consists of a radiator, water pump, thermostats, fan, shutter and shutter controls, winterization heater, and the necessary lines and fittings to connect these components. The flow control thermostat, located in the elbow on the cylinder head, regulates the flow of coolant pumped through the engine block by the water pump. The shutter is controlled by the shutter control thermostat, located at the base of the radiator, or can be operated manually. It controls the amount of air drawn through the radiator by the fan. The fan guard serves to protect personnel from the fan. A winterization heater is provided to heat the coolant for cold weather starting. Refer to paragraphs 159 through 164 for information on the winterization heater.

112. Fan Guard

a. Removal. Refer to figure 41 and remove the fan guard from the radiator.

b. Cleaning and Inspection.

- (1) Clean the fan guard and mounting hardware with an approved cleaning solvent and dry thoroughly.
- (2) Inspect for dents, cracks, bends, and other damage. Replace any damaged or defective part.

c. Installation. Refer to figure 41 and install the fan guard on the radiator.

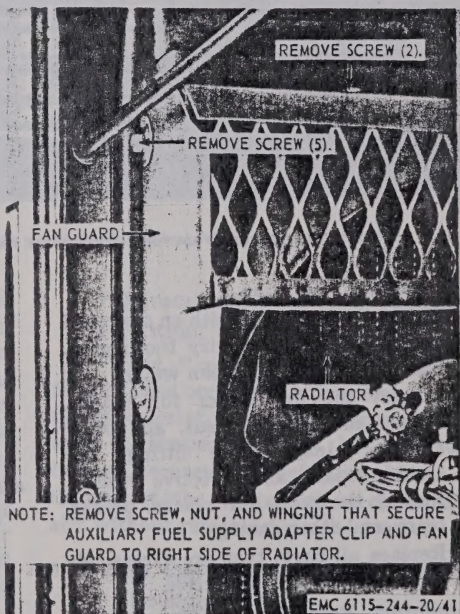


Figure 41. Fan guard, removal and installation.

113. Coolant Draincocks, Drain Hoses, and Fittings

a. Removal. Refer to figure 42 and remove the coolant draincocks, drain hoses, and fittings from the generator set.

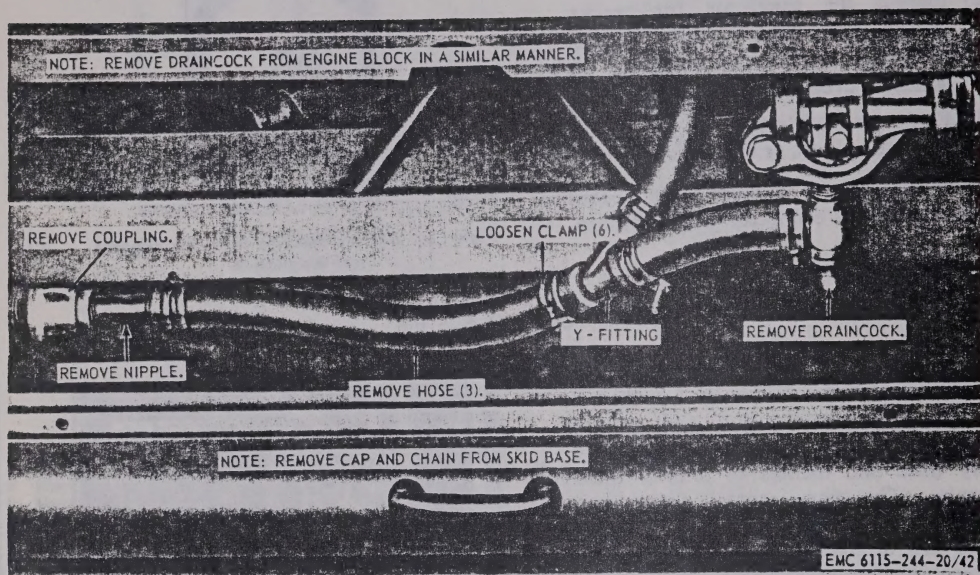


Figure 42. Coolant draincocks, drain hoses, and fittings, removal and installation.

b. Cleaning and Inspection.

- (1) Clean all metal parts with an approved cleaning solvent and dry thoroughly. Clean the hoses with clean water.
- (2) Inspect the draincocks for cracks, breaks, defective threads, and other damage. Inspect the fittings for cracks, breaks, and defective threads. Inspect the hoses for cracks, breaks, tears, and other damage.
- (3) Replace all parts that are excessively damaged, worn, or defective.

c. Installation. Refer to figure 42 and install the coolant draincocks, drain hoses, and fittings on the generator set.

114. Shutter, Shutter Control Thermostat, and Shutter Controls

a. Removal.

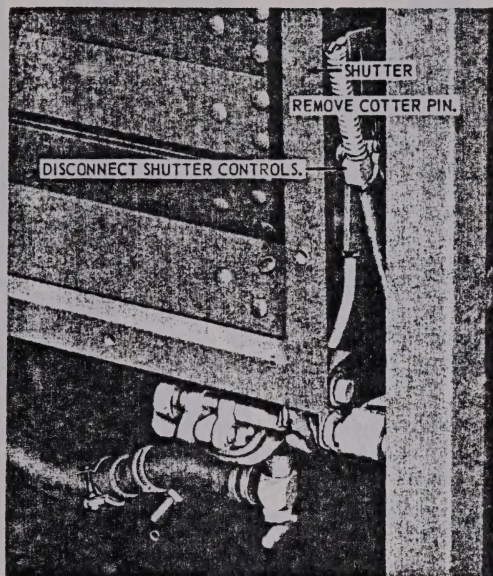
- (1) Remove the grille assembly (par. 66).

- (2) Remove the front panel (par. 68).
- (3) Remove the coolant draincock (par. 113).
- (4) Refer to figure 43 and remove the shutter and shutter controls from the generator set.

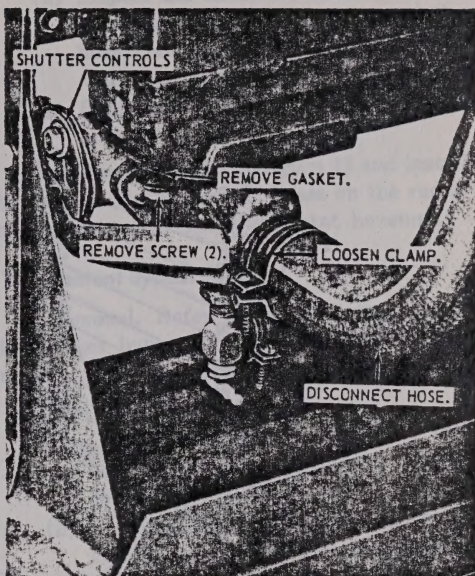
b. Disassembly. Refer to figure 44 and disassemble the shutter and shutter controls.

c. Cleaning, Inspection, and Repair.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the thermostat and flange for visual damage. Inspect the gasket for breaks and tears. Inspect the mounting hardware and other parts for bends, cracks, defective threads, and other damage.
- (3) Repair or replace all parts that are excessively damaged, worn, or defective.



A. SHUTTER AND SHUTTER CONTROLS.



B. SHUTTER CONTROLS.

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Figure 43. Shutter and shutter controls, removal and installation.

d. *Shutter Control Thermostat Testing.* Test the shutter control thermostat for proper opening by submerging it in a container of water. Position a thermometer in the water and heat the container. When the thermometer indicates between 170° and 175° Fahrenheit, the thermostat should start to open and should be completely open when the temperature reaches 190° to 195° Fahrenheit. Remove the thermostat from the water. The cooler surrounding air should cause a pronounced closing action and the unit should be completely closed within a short time.

e. *Reassembly.* Refer to figure 44 and reassemble the shutter and shutter controls.

f. *Installation.*

- (1) Refer to figure 43 and install the shutter and shutter controls on the generator set.
- (2) Install the coolant draincock (par. 113).

- (3) Install the front panel (par. 68).

- (4) Install the grille assembly (par. 66).

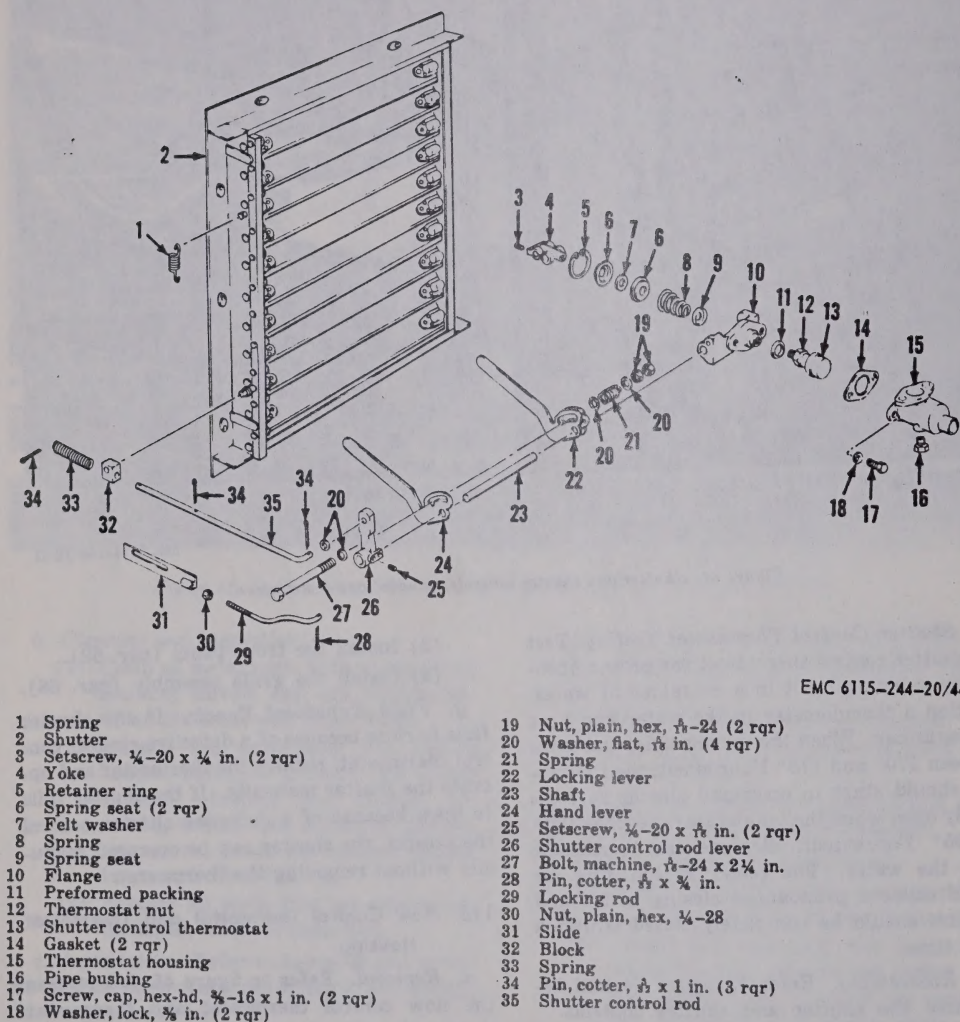
g. *Field Expedient Repair.* If the shutter fails to close because of a defective shutter control thermostat, remove the thermostat and operate the shutter manually. If the shutter fails to open because of a defective shutter control thermostat, the shutter can be operated manually without removing the thermostat.

115. Flow Control Thermostat and Thermostat Housing

a. *Removal.* Refer to figure 45 and remove the flow control thermostat and thermostat housing from the engine cylinder head.

b. *Cleaning and Inspection.*

- (1) Clean the thermostat with clean water. Clean the housing with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the thermostat for visual dam-



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Figure 44. Shutter, shutter control thermostat, and shutter controls, disassembly and reassembly.

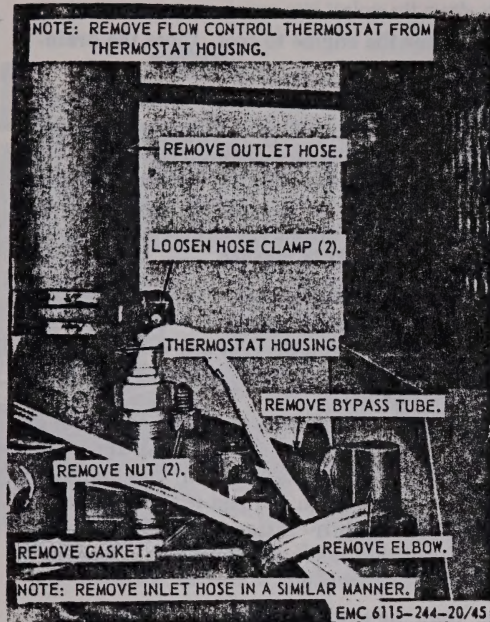


Figure 45. Flow control thermostat, thermostat housing, coolant inlet and outlet hoses, and coolant bypass tube, removal and installation.

age. Test the thermostat as outlined in paragraph 114. Inspect the housing and mounting hardware for cracks, breaks, and other damage.

- (3) Replace all parts that are damaged, worn, or defective.

c. Installation. Refer to figure 45 and install the flow control thermostat and thermostat housing on the cylinder head.

d. Field Expedient Repair. If the engine overheats because of a defective flow control thermostat, remove the thermostat and operate the engine until a new thermostat can be obtained.

116. Coolant Inlet and Outlet Hoses

a. Removal. Refer to figure 45 and remove the coolant inlet and outlet hoses from the radiator, water pump, and thermostat housings.

b. Cleaning and Inspection.

- (1) Clean the hoses with clean water and

the hose clamps with an approved cleaning solvent and dry thoroughly.

- (2) Inspect the hoses for cracks, breaks, tears, and other damage. Inspect the hose clamps for defective hardware and other damage.

- (3) Replace a defective or damaged hose or hose clamp.

c. Installation. Refer to figure 45 and install the coolant inlet and outlet hoses on the radiator, water pump, and thermostat housings.

117. Coolant Bypass Tube

a. Removal. Refer to figure 45 and remove the coolant bypass tube from the thermostat housing and the water pump.

b. Cleaning and Inspection.

- (1) Clean the bypass tube and elbow with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the bypass tube and elbow for cracks, breaks, defective threads, and other damage.

- (3) Replace damaged or defective parts.

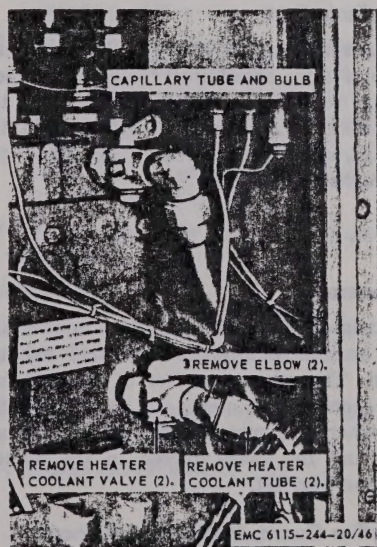


Figure 46. Heater coolant valves, heater coolant tubes, and water temperature gage capillary tube and thermometer, removal and installation.

c. *Installation.* Refer to figure 45 and install the coolant bypass tube between the thermostat housing and the water pump.

118. Heater Coolant Valves and Tubes

a. *Removal.*

- (1) Remove the thermostatic switch (par. 161).
- (2) Refer to figure 46 and remove the heater coolant valves and tubes from the engine block and heater.

b. *Cleaning and Inspection.*

- (1) Clean the heater coolant valves and tubes with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the valves and tubes for cracks, breaks, defective threads, and other damage.
- (3) Replace damaged or defective parts.

c. *Installation.*

- (1) Refer to figure 46 and install the heater coolant valves and lines on the engine block and heater.
- (2) Install the thermostatic switch (par. 161).

119. Radiator Flushing

a. Start the engine and run it at slightly faster than idling speed until the water temperature gage registers 180° Fahrenheit. Stop the engine, remove the radiator cap, remove the drain caps, open the draincocks, and allow the cooling system to drain.

Note. To prevent dampness around the operating area, drain the coolant into containers.

b. Allow the engine to cool. Close the draincocks.

c. Refill the cooling system with clean, fresh water and the recommended quantity of an approved cooling system cleaning compound. Install the radiator cap. Start the engine and run it at slightly faster than idling speed for at least 30 minutes after operating temperature (180° Fahrenheit) is reached.

d. Stop the engine and drain the cooling system. Close the draincocks.

Note. Always neutralize the cooling system with an approved neutralizing compound after a cleaning compound has been used.

e. Allow the engine to cool. Fill the cooling system with clean, fresh water and an approved neutralizing compound. Install the radiator cap. Start the engine and run it for at least 10 minutes at slightly faster than idling speed after the engine has reached operating temperature (180° Fahrenheit).

f. Stop the engine and drain the cooling system.

g. Allow the engine to cool. Fill the cooling system with clean, fresh water.

h. Start the engine and bring it up to operating temperature.

i. Stop the engine and drain the cooling system.

j. Repeat g, h, and i above until the water runs clear.

Section XII. EXHAUST SYSTEM

120. General

The exhaust system consists of a muffler and raincap and a combined intake and exhaust manifold. The exhaust portion of the manifold permits combustion gases to escape to the muffler where the engine combustion noises are reduced and the gases ducted to the outside of the generator set.

121. Muffler Guard, Muffler, and Raincap

a. *Removal.* Refer to figure 47 and remove the muffler guard, muffler, and raincap from the generator set.

b. *Cleaning and Inspection.*

(1) Clean all parts, using a cloth dampened with an approved cleaning solvent and dry thoroughly.

(2) Inspect the muffler for burned or rusted spots, holes, broken or cracked welds, and other damage. Inspect the raincap, muffler guard, and mounting hardware for cracks, breaks, and other damage.

(3) Replace all parts that are excessively damaged, worn, or defective.

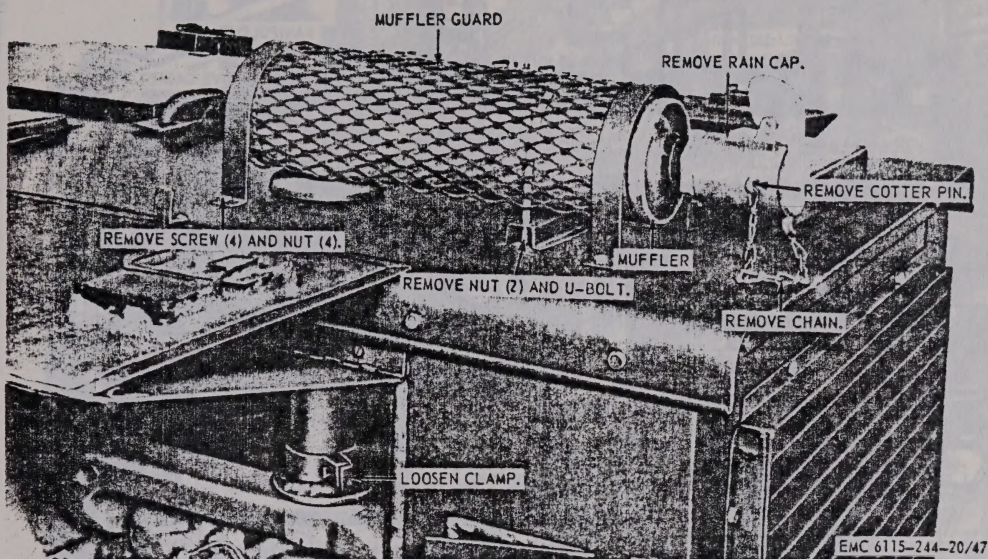


Figure 47. Muffler guard, muffler, and raincap, removal and installation.

c. *Installation.* Refer to figure 47 and install the muffler guard, muffler, and raincap on the generator set.

122. Manifold and Manifold Flange

a. *Removal.*

- (1) Remove the carburetor (par. 74).
- (2) Remove the primer fuel tubes and fittings (par. 79).
- (3) Refer to figure 48 and remove the manifold and manifold flange from the engine.

b. *Cleaning and Inspection.*

- (1) Remove all traces of the gasket from the manifold, manifold flange, and engine block. Clean the manifold and

manifold flange with an approved cleaning solvent and dry thoroughly.

- (2) Examine the mounting surfaces of the manifold and manifold flange for warpage. Inspect for pits and leaks which may be detected by discoloration. Inspect the mounting nuts and studs for cracks, breaks, defective threads, and other damage.
- (3) Replace all parts that are damaged or defective.

c. *Installation.*

- (1) Refer to figure 48 and install the manifold and manifold flange on the engine.
- (2) Install the primer fuel tubes and fittings (par. 79).
- (3) Install the carburetor (par. 74).

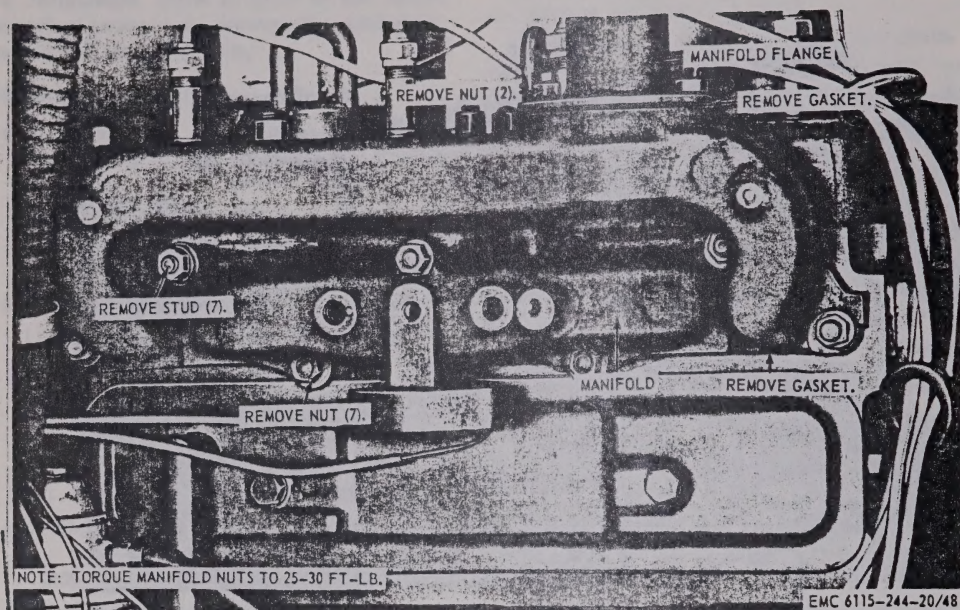


Figure 48. Manifold and manifold flange, removal and installation.

Section XIII. ENGINE MAINTENANCE INSTRUCTIONS

123. General

The engine maintenance instructions within this section will be confined to the cylinder head, timing hole cover, expansion plugs, valve chamber cover, and valve adjustment.

124. Cylinder Head

a. Removal.

- (1) Drain the cooling system (TM 5-6115-244-10).
- (2) Remove the thermostat housing (par. 115).
- (3) Remove the spark plugs and spark plug wires (par. 98).
- (4) Remove the oil filter and oil filter mounting bracket (par. 93).
- (5) Disconnect the capillary tube and thermometer from the cylinder head (par. 132).
- (6) Refer to figure 49 and remove the cylinder head from the engine.

b. Cleaning and Inspection.

- (1) Remove the carbon and any trace of the cylinder head gasket from the cylinder head with an approved cleaning solvent and suitable scrapers. Dry thoroughly.

Caution: Exercise care so as not to nick, scratch, or otherwise damage the machined mating surface of the cylinder head.

- (2) Protect the piston openings of the block assembly with suitable covering and carefully scrape any accumulated carbon or any trace of the cylinder head gasket from the top of the block assembly.
- (3) Inspect the cylinder head for cracks, breaks, and other damage. Check the flatness of the machined mating surface with a straightedge and a feeler gage in 3 positions lengthwise and 5 positions crosswise. The maximum

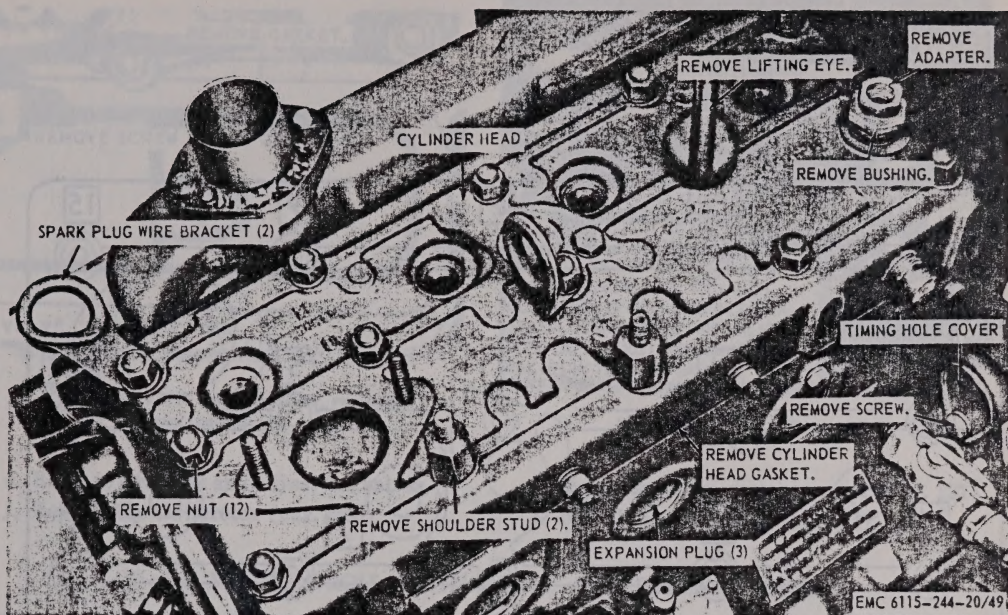


Figure 49. Cylinder head, timing hole cover, and expansion plugs, removal and installation.

permissible warpage is 0.004 inch in the center lengthwise, gradually decreasing toward the ends, or 0.003 inch crosswise in localized low spots. Replace a damaged, defective, or excessively warped cylinder head.

- (4) Inspect the mounting hardware for bends, cracks, defective threads, and other damage. Replace a damaged part.

c. Installation.

- (1) Refer to figures 49 and 50 and install the cylinder head on the engine.
- (2) Connect the capillary tube and thermometer (par. 132).
- (3) Install the oil filter and oil filter mounting bracket (par. 93).
- (4) Install the spark plugs and spark plug wires (par. 98).
- (5) Install the thermostat housing (par. 115).
- (6) Fill the cooling system (TM 5-6115-244-10).

125. Timing Hole Cover

a. Removal. Refer to figure 49 and remove the timing hole cover from the flywheel housing.

b. Cleaning and Inspection.

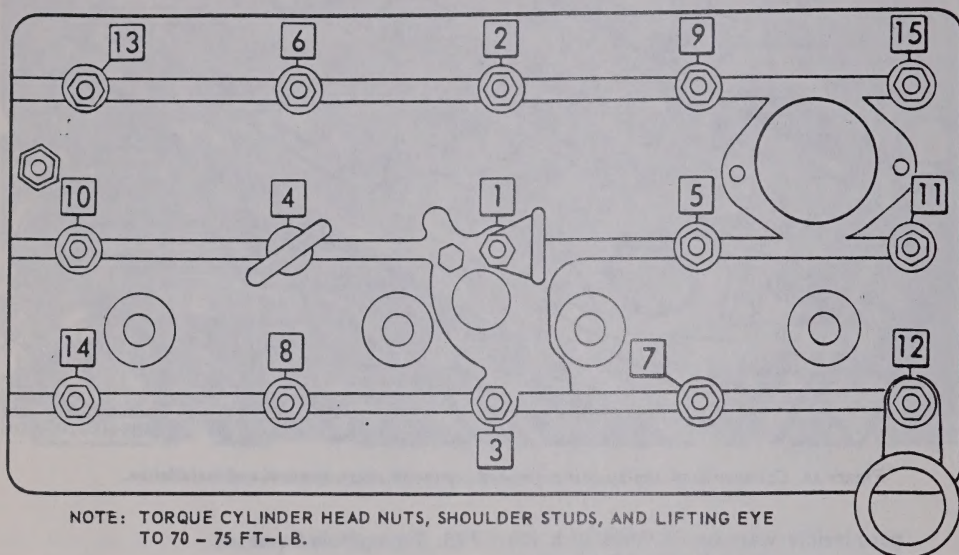
- (1) Clean the timing hole cover and mounting hardware with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the parts for damage and defects. Replace damaged or defective parts.

c. Installation. Refer to figure 49 and install the timing hole cover on the flywheel housing.

126. Expansion Plugs

a. Removal. Remove a damaged expansion plug (fig. 49) by piercing the plug with a sharp pointed tool and prying out.

b. Installation. Install a new expansion plug by tapping it in gradually with a punch and hammer.



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Figure 50. Cylinder head nut tightening sequence.

127. Valve Chamber Cover

a. Removal.

- (1) Remove the carburetor (par. 74).
- (2) Refer to figure 51 and remove the valve chamber cover from the engine.

b. Cleaning and Inspection.

- (1) Clean the valve chamber cover and mounting hardware with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the cover for cracks, breaks, warpage, and other damage. Inspect the hardware for damage and defects.
- (3) Replace a damaged or defective part.

c. Installation.

- (1) Refer to figure 51 and install the valve chamber cover on the engine.
- (2) Install the carburetor (par. 74).

128. Valve Adjustment

a. Remove the carburetor (par. 74).

b. Remove the valve chamber cover (par. 127).

c. Install the carburetor (par. 74).

d. Start the engine and bring it up to operating temperature (TM 5-6115-244-10).

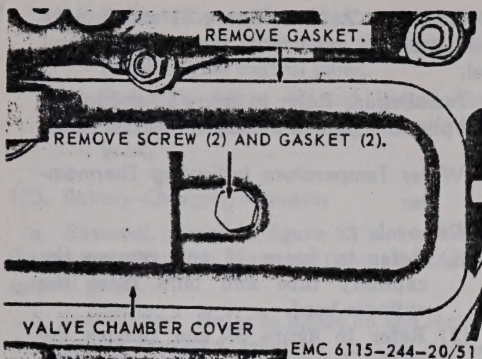


Figure 51. Valve chamber cover, removal and installation.

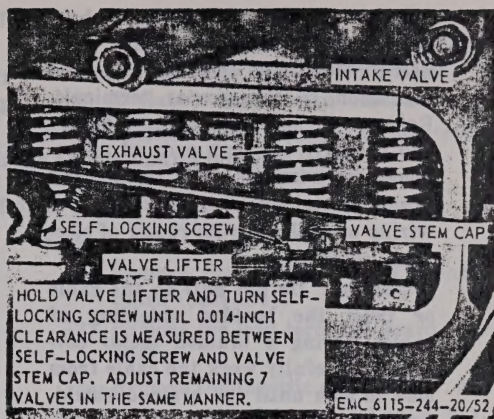


Figure 52. Valve, adjustment.

- e. Refer to figure 52 and adjust the valves.
- f. Remove the carburetor (par. 74).

- g. Install the valve chamber cover (par. 127).
- h. Install the carburetor (par. 74).

Section XIV. CONTROLS, INSTRUMENTS, AND TERMINAL BOARDS

129. General

The controls, instruments, and terminal boards are located at the rear of the generator set. Refer to TM 5-6115-244-10 for a description of these components.

Warning: Do not perform any maintenance on the generator set controls, instruments, or wiring when the unit is operating or when the unit is connected to any external lines. Also disconnect the batteries when performing maintenance on the engine controls and instruments.

130. Wiring

a. *General.* The practical wiring diagram (fig. 2) should be referred to when work on the electrical system is necessary.

Caution: As a precaution against short circuits, disconnect the battery ground cable from the batteries before inspecting, testing, or replacing any wiring.

b. *Cleaning and Inspection.*

- (1) Remove any dust or dirt from the wiring with a clean, dry cloth.
- (2) Inspect the insulation for cracks or fraying. Pay particular attention to

places where wires pass through holes or over rough edges. Wrap cracked or frayed areas with an approved electrical tape. Replace a defective wire.

- (3) Inspect the terminals for cracks, splits, and corrosion. Replace a defective terminal.

c. *Testing.* To test a wire for continuity, disconnect each end of the wire from the components to which it is attached. Touch the probes of a multimeter to each end of the wire. If continuity is not indicated, the wire is defective and must be replaced.

d. *Repair.*

- (1) If a broken wire is accessible, remove sufficient insulation from each side of the break to allow a good connection of the bared ends by twisting them together. Solder the connection and wrap it with electrical tape. Under no condition leave the bare connection exposed.
- (2) If a wire is broken from a terminal connector, replace the connector.
- (3) If a break in a wire is inaccessible, and

the wire is not a part of a wiring harness, disconnect and remove it. Connect a new wire of the same gage and insulation to the proper terminals. Refer to the wiring diagram (fig. 2) and properly tag both ends of all replacement wires. Always replace any braided metal shielding removed from wiring or cables during repair of electrical systems.

Caution: Do not pull on the cable or twist the braided shielding of cables having a braided metal covering. Carefully work the cable from side to side until the braided shielding is sufficiently loose to allow removal of the cable.

131. Oil Pressure Gage

a. Removal. Refer to figure 53 and remove the oil pressure gage from the engine control panel.

b. Installation. Refer to figure 53 and install the oil pressure gage in the engine control panel.

132. Water Temperature Indicating Thermometer

a. Removal.

(1) Refer to figure 46 and remove the capillary tube and bulb from the cylinder head.

(2) Refer to figure 53 and remove the water temperature indicating thermometer from the engine control panel.

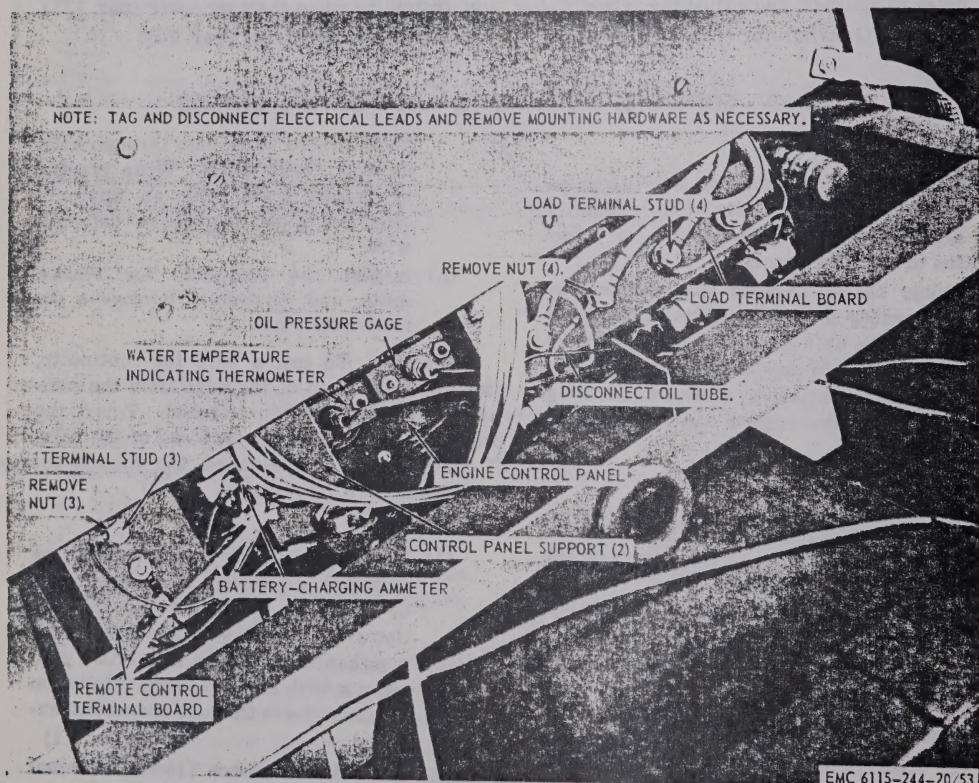


Figure 53. Oil pressure gage, water temperature indicating thermometer, battery-charging ammeter, load terminal board, remote control terminal board, terminal studs, and engine control panel, removal and installation.

b. Installation.

- (1) Refer to figure 53 and install the water temperature indicating thermometer in the engine control panel.
- (2) Refer to figure 46 and install the capillary tube and bulb on the cylinder head.

133. Battery-Charging Ammeter

a. Removal. Refer to figure 53 and remove the battery-charging ammeter from the engine control panel.

b. Installation. Refer to figure 53 and install the battery-charging ammeter in the engine control panel.

134. Load Terminal Board

a. Removal.

- (1) Remove the load terminal capacitors (par. 52).
- (2) Refer to figure 53 and remove the load terminal board from the engine control panel.

b. Cleaning and Inspection.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the load terminal board for breaks, cracks, and other damage. Inspect the terminal studs, nuts, and mounting hardware for bends, cracks, defective threads, and other damage.
- (3) Replace any damaged or defective part.

c. Installation.

- (1) Refer to figure 53 and install the load terminal board on the engine control panel.
- (2) Install the load terminal capacitors (par. 52).

135. Remote Control Terminal Board

a. Removal. Refer to figure 53 and remove the remote control terminal board.

b. Cleaning and Inspection.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the terminal board for cracks, breaks, and other damage. Inspect

the terminal studs, nuts, and mounting hardware for bends, cracks, defective threads, and other damage.

- (3) Replace a damaged or defective part.

c. Installation. Refer to figure 53 and install the remote control terminal board.

136. Engine Control Panel

a. Removal.

- (1) Remove the remote control terminal board (par. 135).
- (2) Remove the load terminal board (par. 134).
- (3) Remove the throttle control (par. 87).
- (4) Remove the choke control (par. 86).
- (5) Remove the engine primer pump (par. 84).
- (6) Remove the battery-charging ammeter (par. 133).
- (7) Remove the oil pressure gage (par. 131).
- (8) Remove the water temperature indicating thermometer (par. 132).
- (9) Remove the load terminal capacitors (par. 52).
- (10) Refer to figure 53 and remove the control panel from the control panel supports.

b. Cleaning and Inspection.

- (1) Clean the engine control panel with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the control panel for dents, cracks, bends, and other damage. Inspect the mounting hardware for cracks, defective threads, and other damage.
- (3) Replace an excessively damaged control panel. Replace damaged hardware.

c. Installation.

- (1) Refer to figure 53 and install the control panel on the control panel supports.
- (2) Install the load terminal capacitors (par. 52).
- (3) Install the water temperature indicating thermometer (par. 132).

- (4) Install the oil pressure gage (par. 131).
- (5) Install the battery-charging ammeter (par. 133).
- (6) Install the engine primer pump (par. 84).
- (7) Install the choke control (par. 86).
- (8) Install the throttle control (par. 87).
- (9) Install the load terminal board (par. 134).
- (10) Install the remote control terminal board (par. 135).

137. Alternating Current Ammeter

a. Removal. Refer to figure 54 and remove the alternating current ammeter from the control panel.

Warning: Do not operate the generator set with either the ammeter or the ammeter switch removed or disconnected unless the electrical leads are joined electrically and taped. High voltages developed in an open current transformer can cause death by electrocution.

b. Installation. Refer to figure 54 and install the alternating current ammeter in the control panel.

c. Field Expedient Repair. If the ammeter is defective and it is necessary to operate the generator set without the instrument, disconnect the electrical leads from the ammeter, splice the leads together, and tape the connection.

Warning: If it is necessary to operate the generator set with the ammeter disconnected, short the electrical leads removed from the ammeter and tape joint. Voltages dangerous to equipment and personnel can result from operating with an open current transformer secondary circuit.

138. Alternating Current Ammeter Switch

a. Removal. Refer to figure 54 and remove the ammeter switch from the control panel.

b. Installation. Refer to figure 54 and install the ammeter switch in the control panel.

139. Time-Totalizing Meter

a. Removal. Refer to figure 54 and remove the time-totalizing meter from the control panel.

b. Installation. Refer to figure 54 and install the time-totalizing meter in the control panel.

140. Frequency Meter

a. Removal. Refer to figure 54 and remove the frequency meter from the control panel.

b. Installation. Refer to figure 54 and install the frequency meter in the control panel.

141. Alternating Current Voltmeter

a. Removal. Refer to figure 54 and remove the alternating current voltmeter from the control panel.

b. Installation. Refer to figure 54 and install the alternating current voltmeter in the control panel.

142. Power on Light

a. Removal. Refer to figure 54 and remove the power on light from the control panel.

b. Installation. Refer to figure 54 and install the power on light in the control panel.

143. Emergency Operation Switch

a. Removal. Refer to figure 54 and remove the emergency operation switch from the control panel.

b. Installation. Refer to figure 54 and install the emergency operation switch in the control panel.

144. Heater Switch

a. Removal. Refer to figure 54 and remove the heater switch from the control panel.

b. Installation. Refer to figure 54 and install the heater switch in the control panel.

145. Heater Pilot Light

a. Removal. Refer to figure 54 and remove the heater pilot light from the control panel.

b. Installation. Refer to figure 54 and install the heater pilot light in the control panel.

146. 120-Volt Receptacle

a. Removal. Refer to figure 54 and remove the 120-volt receptacle from the control panel.

b. Installation. Refer to figure 54 and install the 120-volt receptacle in the control panel.

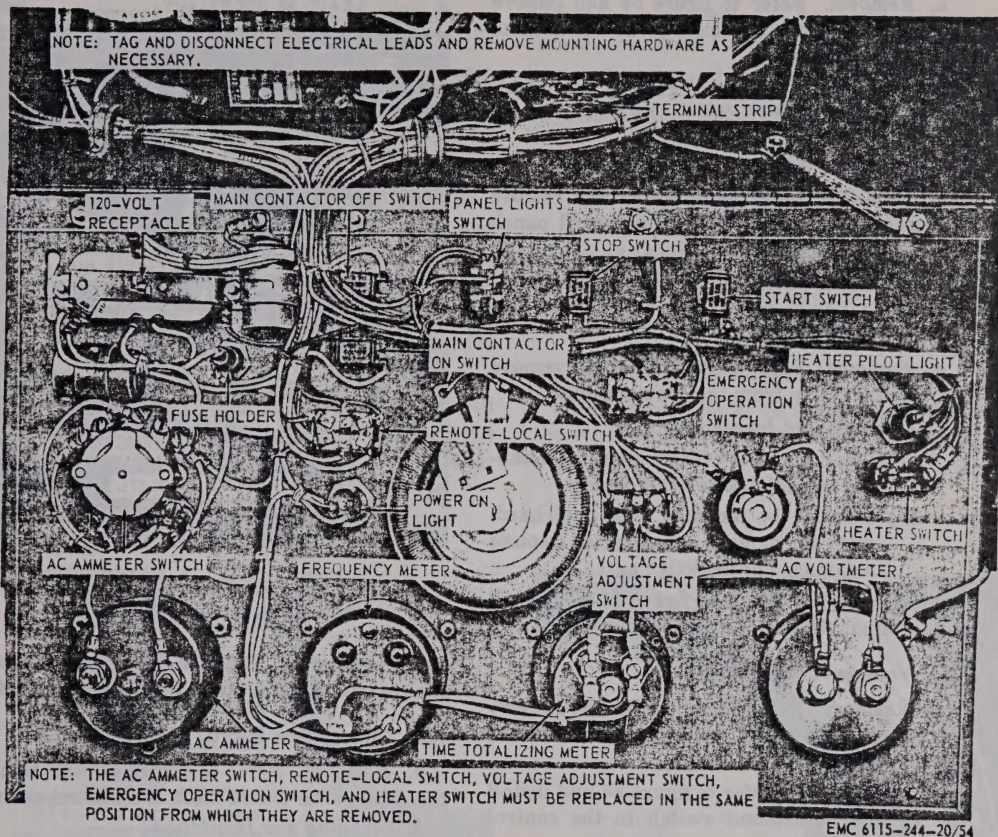


Figure 54. Alternating current ammeter, time totalizing meter, frequency meter, voltmeter, ammeter switch, power on light, emergency operation switch, heater switch, heater pilot light, 120-v receptacle, main contactor on and off switches, fuse holder, remote-local switch, start and stop switches, voltage adjustment switch, terminal strip, removal and installation.

147. Main Contactor On and Off Switches

a. *Removal.* Refer to figure 54 and remove the main contactor on and off switches from the control panel.

b. *Installation.* Refer to figure 54 and install the main contactor on and off switches in the control panel.

148. Fuse Holder

a. *Removal.*

- (1) Remove the fuse (TM 5-6115-244-10).

- (2) Refer to figure 54 and remove the fuse holder from the control panel.

b. *Installation.*

- (1) Refer to figure 54 and install the fuse holder in the control panel.
- (2) Install the fuse (TM 5-6115-244-10).

149. Remote-Local Switch

a. *Removal.* Refer to figure 54 and remove the remote-local switch from the control panel.

b. *Installation.* Refer to figure 54 and install the remote-local switch in the control panel.

150. Start and Stop Switches

a. *Removal.* Refer to figure 54 and remove the start and stop switches from the control panel.

b. *Installation.* Refer to figure 54 and install the start and stop switches in the control panel.

151. Panel Lights Switch

a. *Removal.* Refer to figure 54 and remove the panel lights switch from the control panel.

b. *Installation.* Refer to figure 54 and install the panel lights switch in the control panel.

152. Terminal Strip

a. *Removal.* Refer to figure 54 and remove the terminal strip from the control cabinet.

b. *Cleaning and Inspection.*

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the terminal strip and hardware for damage and defects. Replace a damaged or defective part.

c. *Installation.* Refer to figure 54 and install the terminal strip in the control cabinet.

153. Voltage Adjustment Switch

a. *Removal.* Refer to figure 54 and remove the voltage adjustment switch from the control panel.

b. *Installation.* Refer to figure 54 and install the voltage adjustment switch in the control panel.

154. Control Panel Lights

a. *Removal.* Refer to figure 55 and remove the control panel lights from the control cabinet.

b. *Cleaning and Inspection.*

(1) Clean the lights with a clean, dry cloth.

(2) Inspect the lights for damage and defects. Replace a damaged or defective light.



Figure 55. Control panel light, changeover board, and terminal studs, removal and installation.

c. *Installation.* Refer to figure 55 and install the control panel lights in the control cabinet.

155. Changeover Board

a. *Removal.* Refer to figure 55 and remove the changeover board from the control cabinet.

b. *Cleaning and Inspection.*

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the changeover board for chips, cracks, breaks, and other damage. Inspect the terminal studs, links, and hardware for damage and defects.

(3) Replace all parts that are damaged or defective.

c. *Installation.* Refer to figure 55 and install the changeover board in the control cabinet.

Section XV. MAIN GENERATOR

156. General

The main generator is equipped with brushes that are located inside the endbell cover. The generator is ventilated with an internal fan that

pulls air in at one end and pushes heated air out at the other end. These ventilation openings are covered with screens. A ventilating shroud is located at the rear of the unit.

157. Ventilating Shroud and Endbell Cover

a. *Removal.* Refer to figure 56 and remove the ventilating shroud from the rear of the housing and the endbell cover from the main generator.

b. *Cleaning and Inspection.*

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the ventilating shroud and endbell cover for dents, cracks, breaks, and other damage. Inspect the mounting hardware for damage and defects.
- (3) Replace any damaged or defective part.

c. *Installation.* Refer to figure 56 and install the endbell cover on the main generator and the ventilating shroud on the rear of the housing.

158. Brushes

a. *Removal.* Refer to figure 57 and remove the brushes from the brush holders.

b. *Cleaning and Inspection.*

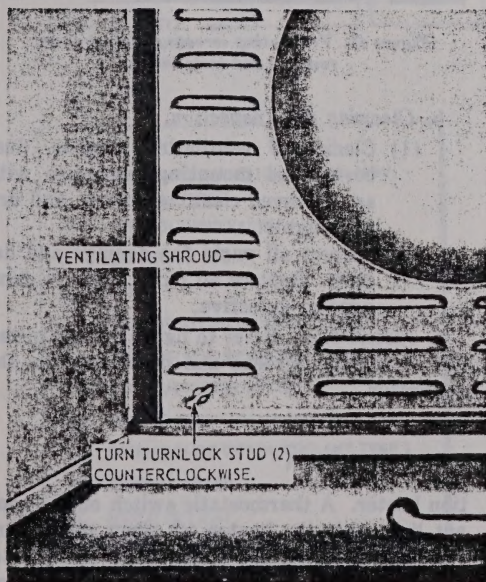
- (1) Clean the brushes with a clean, dry cloth.
- (2) Inspect the brushes for cracks, chips, wear, and other damage. Discard a defective brush.

Note. Allowable wear limit for a brush is three-eighths inch.

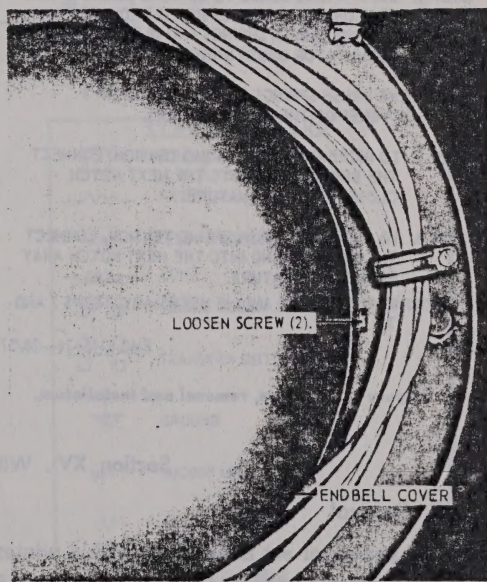
c. *Installation.* Refer to figure 57 and install the brushes in the brush holders.

159. Ventilating Screens and Dust Cover

a. *Removal.* Refer to figure 58 and remove the ventilating screens and dust cover from the generator.



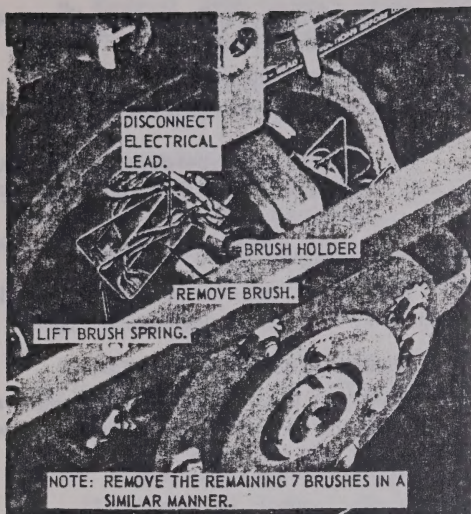
A. VENTILATING SHROUD.



B. ENDBELL COVER.

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Figure 56. Ventilating shroud and endbell cover, removal and installation.



BRUSH SPRING TENSION ADJUSTMENT:

STEP 1. USE A SPRING SCALE TO MEASURE BRUSH SPRING TENSION. CORRECT TENSION IS 24 OUNCES FOR SLIPRING BRUSH SPRINGS AND 28 OUNCES FOR COMMUTATOR BRUSH SPRINGS.

NOTE: THE BRUSH SPRINGS CONNECT INTO 1 OF 3 NOTCHES OF THE BRUSH HOLDERS.

STEP 2. TO INCREASE BRUSH SPRING TENSION, CONNECT THE BRUSH SPRING INTO THE NEXT NOTCH CLOSER TO THE ARMATURE.

STEP 3. TO DECREASE BRUSH SPRING TENSION, CONNECT THE BRUSH SPRING INTO THE NEXT NOTCH AWAY FROM THE ARMATURE.

STEP 4. REPEAT STEP 1 AND, IF NECESSARY, STEPS 2 AND 3.

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Figure 57. Brushes, removal and installation.

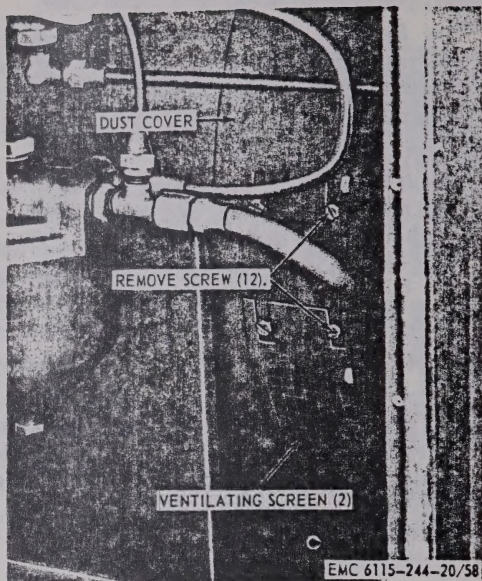


Figure 58. Ventilating screens and dust cover, removal and installation.

b. Cleaning and Inspection.

- (1) Clean the ventilating screens, dust cover, and mounting hardware with an approved cleaning solvent and dry thoroughly.
- (2) Inspect all parts for damage and defects. Replace all parts that are damaged or defective.

c. Installation. Refer to figure 58 and install the ventilating screens and dust cover on the generator.

Section XVI. WINTERIZATION SYSTEM

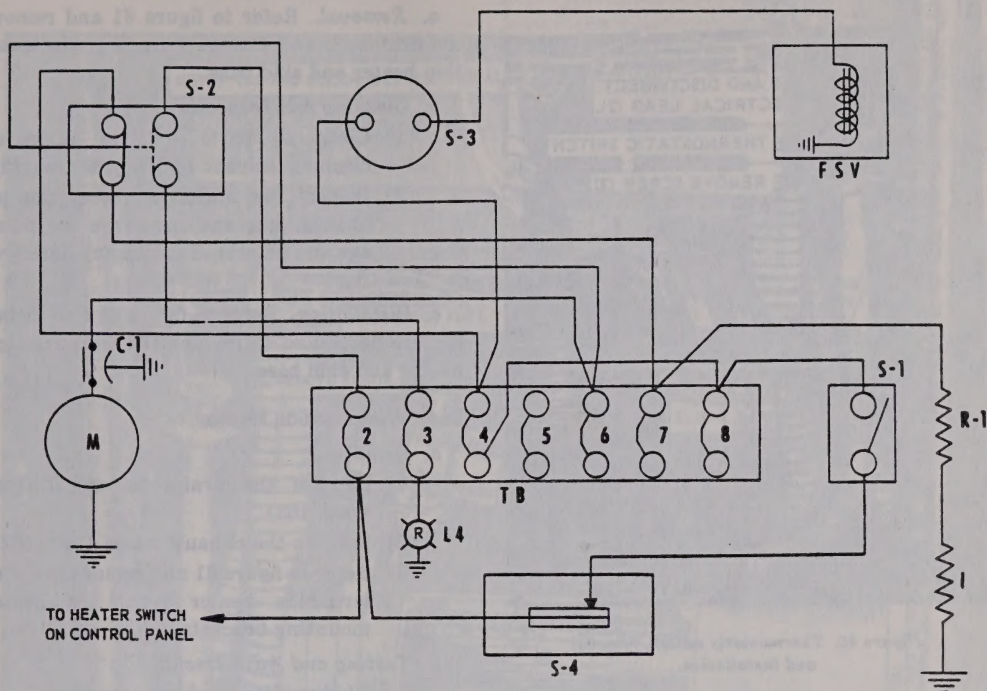
160. General

The generator set is provided with a winterization heater to enable the unit to operate at low ambient temperatures. Gasoline is gravity fed from the fuel tank through the heater three-way fuel valve, located on the right side of the unit below the fuel tank. The fuel goes from the heater three-way fuel valve to the solenoid valve mounted on top of the winteriza-

tion heater. A thermostatic switch on the coolant line shuts the heater off when the coolant reaches a temperature of 180° Fahrenheit. Refer to figure 59 for wiring of the winterization heater.

161. Thermostatic Switch

a. Removal. Refer to figure 60 and remove the thermostatic switch from the heater coolant tube.



DEVICE LEGEND

- C-1 FEED-THRU CAPACITOR, 0.25-UF, 100-V, DC, 20-AMPERES
 FSV FUEL SOLENOID VALVE
 I IGNITER, 0.4 OHM
 M MOTOR
 R-1 FIXED RESISTOR, 1.75-OHMS, 250-WATTS
 S-1 THERMOSTATIC SWITCH (BATTERY BOX)
 S-2 FLAME DETECTOR SWITCH
 S-3 OVERHEAT CONTROL THERMOSTAT
 S-4 THERMOSTATIC SWITCH (COOLANT TEMP.)
 TB TERMINAL BOARD
 L4 INDICATOR LIGHT

SYMBOL LEGEND

- INDICATING LAMP (RED)
 RESISTOR
 FEED-THRU CAPACITOR
 COIL
 SINGLE POLE - SINGLE THROW SWITCH
 TRANSFER SWITCH
 GROUND
 UF MICROFARAD
 V VOLTS
 DC DIRECT CURRENT

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Figure 59. Winterization heater wiring diagram.

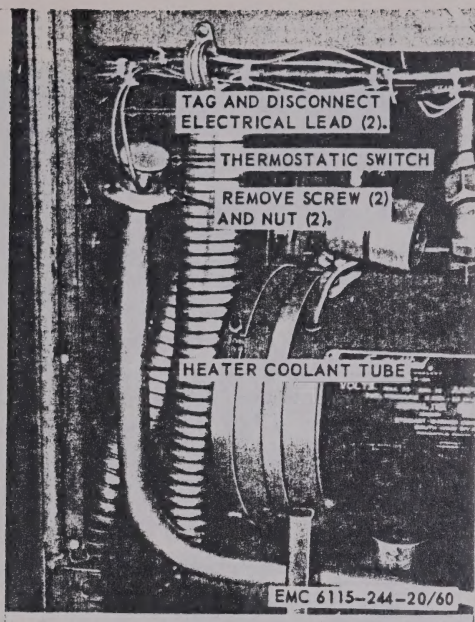


Figure 60. Thermostatic switch, removal and installation.

b. Cleaning and Inspection.

- (1) Clean the thermostatic switch and attached wiring with a clean, dry cloth.
- (2) Inspect the switch for damage. Replace a damaged or defective switch.

c. Installation. Refer to figure 60 and install the thermostatic switch on the coolant inlet line.

162. Exhaust Hoses

a. Removal. Refer to figure 38 and remove the exhaust hoses from the winterization heater and battery box.

b. Cleaning and Inspection.

- (1) Clean the exhaust hoses with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the hoses for cracks, breaks, leaks, and other damage. Replace a defective hose.

c. Installation. Refer to figure 38 and install the exhaust hoses on the winterization heater and battery box.

163. Draincock and Fittings

a. Removal. Refer to figure 61 and remove the draincock and fittings from the winterization heater and skid base.

b. Cleaning and Inspection.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the draincock, hose, clamps, fittings, cap, and hardware for damage and defects. Replace any defective part.

c. Installation. Refer to figure 61 and install the draincock and fittings on the winterization heater and skid base.

164. Winterization Heater

a. Removal.

- (1) Remove the draincock and fittings (par. 163).
- (2) Remove the exhaust hoses (par. 162).
- (3) Refer to figure 61 and remove the winterization heater from the heater mounting brackets.

b. Testing and Adjustment.

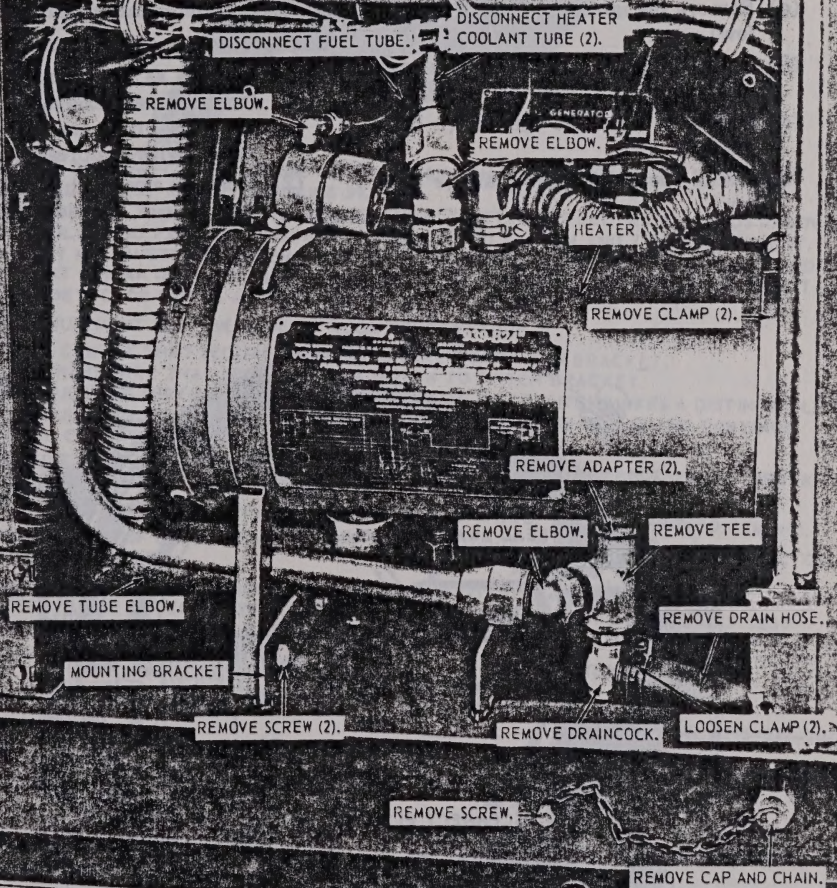
(1) Blower motor and fan assembly.

- (a) Remove the blower motor and fan assembly (c below).
- (b) Touch the probes of a multimeter to the end of the electrical lead and to the blower motor housing. No continuity reading is an indication that the blower motor is defective and must be replaced. Report a defective blower motor to field maintenance or replace the blower motor and fan assembly.

(c) Install the blower motor and fan assembly (e below).

- (2) **Overheat control thermostat.** Disconnect one of the thermostat electrical leads from the terminal board. Connect a multimeter across the two thermostat terminals and test for continuity. The thermostat is normally closed and should show continuity. Replace a defective overheat control thermostat.

NOTE: TAG AND DISCONNECT ELECTRICAL LEADS AS NECESSARY.



NOTE: REMOVE THE REMAINING MOUNTING BRACKET IN A SIMILAR MANNER.

EMC 6115-244-20/61

Figure 61. Winterization heater, mounting brackets, draincock, and fittings, removal and installation.

(3) *Fixed resistor.*

- (a) Remove the igniter end plate (c below).
- (b) Refer to figure 62 and test the fixed resistor.
- (c) Replace a defective fixed resistor (c below).
- (d) Install the igniter end plate (e below).

(4) *Igniter.*

- (a) Remove the igniter end plate (c below).
- (b) Refer to figure 62 and test the igniter.
- (c) Replace a defective igniter (c below).
- (d) Install the igniter end plate (e below).

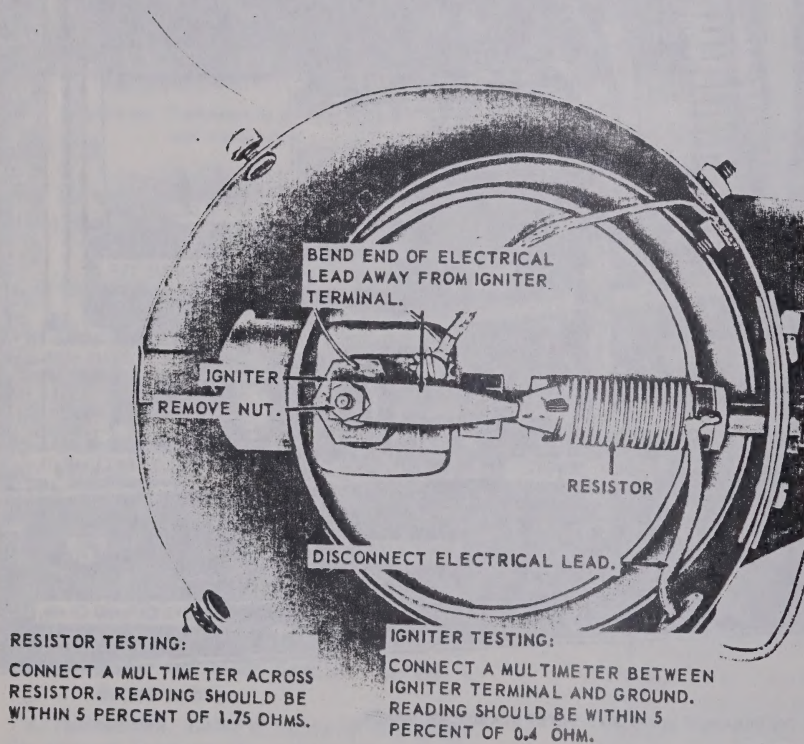
(5) *Flame detector switch.*

- (a) Remove the blower motor and fan assembly (c below).
- (b) Refer to figure 63 and test and adjust the flame detector switch.
- (c) Replace a defective flame detector switch (c below).
- (d) Install the blower motor and fan assembly (e below).

c. *Disassembly.* Refer to figure 64 and disassemble the winterization heater.

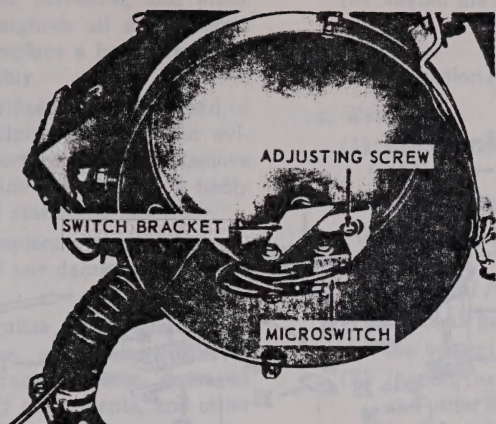
d. *Cleaning, Inspection, and Repair.*

- (1) Remove as much carbon as possible from the heat exchanger ends with a stiff wire brush and blow out all loose carbon with compressed air.
- (2) Clean all electrical parts of the heater with a clean, dry cloth. Clean all other



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Figure 62. Fixed resistor and igniter, testing.



STEP 1. TAG AND DISCONNECT FIVE FLAME DETECTOR SWITCH ELECTRICAL LEADS FROM THE TERMINAL BOARD. REFER TO FIGURE 59.

STEP 2. CONNECT A MULTIMETER AND TEST SUCCESSIVELY BETWEEN ELECTRICAL LEADS REMOVED FROM FOLLOWING PAIRS OF TERMINALS 4 AND 6, 6 AND 7, AND 4 AND 7 FOR CONTINUITY. CONNECT MULTIMETER BETWEEN ELECTRICAL LEADS REMOVED FROM TERMINALS 2 AND 3 AND TEST FOR AN OPEN CIRCUIT. IF INDICATED READINGS ARE NOT OBTAINED, ADJUST THE FLAME DETECTOR SWITCH AS FOLLOWS:

NOTE: THIS ADJUSTMENT MUST BE MADE AT ROOM TEMPERATURE.

STEP 3. REMOVE CEMENT THAT SECURES ADJUSTING SCREW TO SWITCH BRACKET.

STEP 4. LOOSEN HARDWARE THAT SECURES MICROSWITCH TO SWITCH BRACKET.

STEP 5. TURN ADJUSTING SCREW COUNTERCLOCKWISE UNTIL MICROSWITCH MAKES A DISTINCT CLICK.

STEP 6. TURN ADJUSTING SCREW CLOCKWISE UNTIL MICROSWITCH AGAIN CLICKS AND CONTINUE TURNING CLOCKWISE FOR THREE-QUARTERS OF A TURN.

CAUTION: EXERCISE CARE IN TIGHTENING THE ADJUSTING SCREW AS ROUGH HANDLING CAN BREAK THE QUARTZ ROD IN THE FLAME DETECTOR SWITCH.

STEP 7. SECURE ADJUSTING SCREW IN ITS SET POSITION WITH A DROP OF AN APPROVED CEMENT.

CAUTION: EXCESSIVE USE OF CEMENT CAN AFFECT THE FREE MOVEMENT OF THE FLAME DETECTOR SWITCH COMPONENTS.

STEP 8. TIGHTEN HARDWARE THAT SECURES MICROSWITCH TO SWITCH BRACKET.

STEP 9. RETEST FLAME DETECTOR SWITCH (STEPS 1 AND 2 ABOVE). IF CIRCUITS DO NOT TEST SATISFACTORILY, REPLACE THE FLAME DETECTOR SWITCH.

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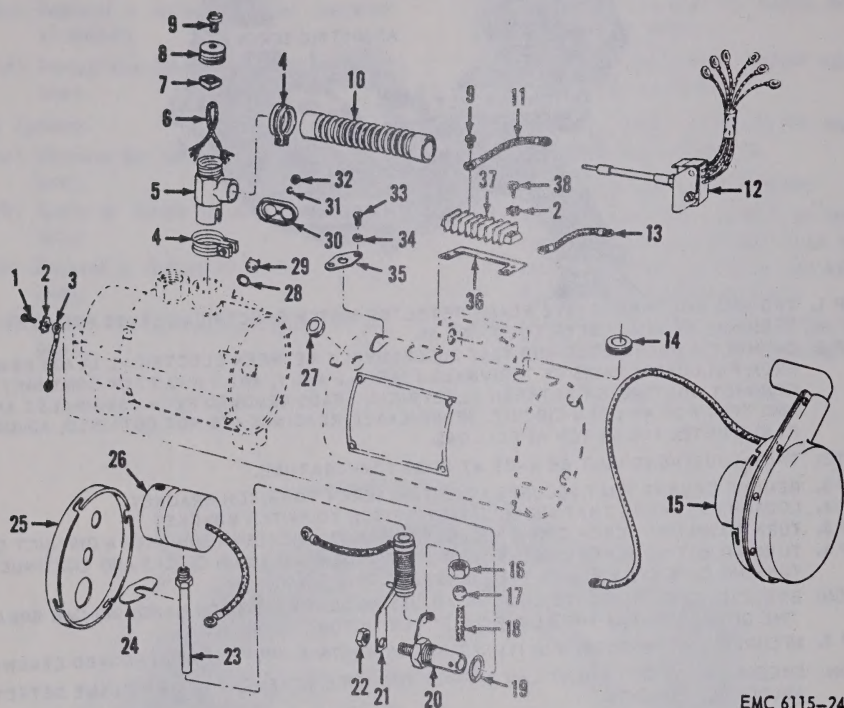
Figure 63. Flame detector switch, testing and adjustment.

parts with a cloth dampened with an approved cleaning solvent and dry thoroughly.

- (3) Inspect the heat exchanger ends and heater housing for distortion, broken welds, and damaged threads. Report a defective heat exchanger or heater housing to field maintenance.
- (4) Inspect the flexible air duct for cracks,

frayed, and deteriorated areas. Replace if damaged.

- (5) Inspect all electrical leads of the heater components for frayed insulation and loose or damaged terminal lugs. Repair or replace any damaged electrical lead.
- (6) Inspect the igniter end plate and blower motor and fan assembly for



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- | | | | |
|----|--|----|--|
| 1 | Screw, pan-hd, No. 8-32 x $\frac{1}{4}$ in. | 20 | Igniter |
| 2 | Washer, lock, ET, No. 8 (14 rqr) | 21 | Fixed resistor |
| 3 | Bonding strap | 22 | Nut, plain, hex, brass, No. 8-32 (3 rqr) |
| 4 | Hose clamp (3 rqr) | 23 | Fuel standpipe |
| 5 | Combustion air tee | 24 | Support plate |
| 6 | Wick rope | 25 | Igniter end plate |
| 7 | Spring nut (spec) | 26 | Fuel solenoid valve |
| 8 | Wick cap | 27 | Grommet |
| 9 | Screw, machine, rd-hd, No. 6-32 x $\frac{1}{4}$ in. (15 rqr) | 28 | Preformed packing |
| 10 | Air duct hose | 29 | Overheat control thermostat |
| 11 | Electrical lead assembly | 30 | Thermostat cover |
| 12 | Flame detector switch | 31 | Washer, lock, No. 10 |
| 13 | Electrical lead assembly | 32 | Nut, plain, hex, No. 10-32 |
| 14 | Grommet | 33 | Screw, machine, hex-hd, No. 8-32 x $\frac{1}{4}$ in. (2 rqr) |
| 15 | Blower motor and fan assembly | 34 | Washer, lock, No. 8 (2 rqr) |
| 16 | Tube coupling nut (spec) | 35 | Tube flange |
| 17 | Compression collar | 36 | Marker strip |
| 18 | Burner wick | 37 | Terminal board |
| 19 | Copper igniter gasket | 38 | Screw, machine, fil-hd, No. 8-32 x $\frac{1}{4}$ in. (4 rqr) |

Figure 64. Winterization heater, partial disassembly and reassembly.

cracks, breaks, corrosion, and other damage. Straighten all minor dents or bends or replace a badly damaged part or assembly.

- (7) Inspect the orifice in the upper end of the fuel standpipe assembly for evidence of distortion or burs. Remove burs with a fine file. Replace a badly damaged fuel standpipe assembly.
- (8) Inspect and replace a damaged terminal board and any damaged hardware and fittings.
- (9) Inspect the igniter, fixed resistor, fuel solenoid valve, and flame detector switch for cracks, breaks, damaged threads, faulty components, and other damage. Replace any damaged or defective part.

e. Reassembly. Refer to figure 61 and reassemble the winterization heater.

f. Installation.

- (1) Refer to figure 61 and install the winterization heater on the heater mounting brackets.
- (2) Install the exhaust hoses (par. 162).

- (3) Install the draincock and fittings (par. 163).

165. Winterization Heater Mounting Brackets

a. Removal.

- (1) Remove the winterization heater (par. 164).
- (2) Refer to figure 61 and remove the winterization heater mounting brackets from the generator set.

b. Cleaning and Inspection.

- (1) Clean all parts with an approved cleaning solvent and dry thoroughly.
- (2) Inspect the brackets for cracks, bends, and other damage. Inspect the mounting hardware for damage and defects. Replace any damaged or defective part.

c. Installation.

- (1) Refer to figure 61 and install the winterization heater mounting brackets on the generator set.
- (2) Install the winterization heater (par. 164).

CHAPTER 4

SHIPMENT AND LIMITED STORAGE

Section I. SHIPMENT WITHIN ZONE OF INTERIOR

166. Preparation of Equipment for Shipment

a. *General.* Detailed instructions for the preparation of the generator set for domestic shipment are outlined within this section. Preservation will be accomplished in a sequence that will not require the operation of previously preserved components.

b. *Inspection.* The generator set will be inspected for unusual conditions such as damage, rusting, accumulation of water, and pilferage. DA Form 464, Work Sheet for Preventive Maintenance and Technical Inspection of Engineer Equipment, will be executed on the equipment.

c. *Cleaning and Drying.* Thorough cleaning and drying by an approved technique is the first essential procedure in any effective preservation process. Approved methods of cleaning, drying, types of preservatives, and methods of application are described in TM 38-230.

d. *Painting.* Paint all surfaces where the paint has been removed or damaged. Refer to TB ENG 60 for detailed cleaning and painting instructions.

e. *Depreservation Guide.* DA Form 2258, Depreservation Guide of Engineer Equipment.

- (1) A properly annotated depreservation guide will be completed concurrently with preservation for each item of mechanical equipment with any peculiar requirements outlined in the Remarks column. The completed depreservation guide will be placed with the equipment in a waterproof envelope, marked "Depreservation Guide," and fastened in a conspicuous location on or near the operator's controls.
- (2) Prior to placing equipment in operation or to the extent necessary for in-

spection, depreservation of the item shall be performed as outlined on the Depreservation Guide.

f. *Cooling System.* Completely drain the cooling system including the radiator and block and the winterization heater. Flush with clean water. Leave draincocks open.

g. *Lubrication System.* Check level of lubricant. Operate the engine at a fast idle until lubricant has been circulated throughout the system. The crankcase will then be drained, the drain valve closed, and the drain cap reinstalled.

h. *Sealing of Openings.* Openings that will permit the direct entry of water into the interior of the generator set shall be sealed with pressure-sensitive tape conforming to Specification PPP-T-60, type III, class 1.

i. *Fuel Tank.* Drain fuel tank after engine preservation and fog interior with preservative oil, type P-10, grade 2, conforming to Specification MIL-L-21260.

j. *Air Cleaner.* Drain the air cleaner.

k. *Exterior Surface.* Coat exposed machined ferrous metal surfaces with preservative (P-6) conforming with Specification MIL-C-11796, class 3. If preservative is not available, cup grease may be used.

l. *Marking.* Shall conform to MIL-STD-129.

m. *Batteries and Cables.* Batteries shall be secured in the battery compartment. Batteries shall be filled and fully charged. Cables shall be disconnected, vent holes sealed, and all terminals wrapped and secured with type III, class 1, pressure-sensitive tape conforming to Specification PPP-T-60.

n. *Disassembly, Disassembled Parts, and Basic Issue Items.*

- (1) Disassembly shall be limited to the removal of parts and projecting components that tend to increase the overall profile of the equipment and that which is subject to pilferage.
- (2) Disassembled items shall be packed with the publications in the toolbox if possible. Otherwise, items will be packed in a suitable container and secured to the equipment to prevent loss or pilferage.

Note. If packing is required to provide adequate protection against damage during

shipment, refer to TM 38-320 for guidance in crate fabrication.

167. Loading Equipment for Shipment

a. Loading by Lifting. A suitable carrier should be used when moving the generator set a long distance. Refer to paragraph 6 for lifting instructions.

b. Loading by Towing. If a lifting device is not available or cannot be used, the generator set may be loaded by towing. Attach a cable to the towing eye of the unit and tow with winch or vehicle.

Section II. LIMITED STORAGE

168. Preparation of Equipment for Storage

a. General. Detailed instructions for preserving and maintaining equipment in limited storage are outlined in this section. Limited storage is defined as storage not to exceed 6 months. Refer to AR 743-505.

b. Inspection. The generator set will be inspected for unusual conditions such as damage, rusting, accumulation of water, and pilferage. DA Form 464, Work Sheet for Preventive Maintenance and Technical Inspection of Engineer Equipment, will be executed on the equipment.

c. Cleaning and Drying. Thorough cleaning and drying by an approved technique is the first essential procedure in any effective preservation process. Approved methods of cleaning, drying, types of preservatives, and methods of application are described in TM 38-230.

d. Painting. Paint all surfaces where the paint has been removed or damaged. Refer to TB ENG 60 for detailed cleaning and painting instructions.

e. Depreservation Guide. DA Form 2258, Depreservation Guide of Engineer Equipment.

- (1) A properly annotated depreservation guide will be completed concurrently with preservation for each item of mechanical equipment with any peculiar requirements outlined in the Remarks column. The completed depreservation guide will be placed with the equipment in a waterproof envelope,

marked "Depreservation Guide," and fastened on or near the operator's controls.

- (2) Prior to placing equipment in operation or to the extent necessary for inspection, depreservation of the item shall be performed as outlined on the Depreservation Guide.

f. Sealing of Openings. Openings that will permit the direct entry of water into the interior of the generator set shall be sealed with pressure-sensitive tape conforming to Specification PPP-T-60, type III, class 1.

g. Fuel Tank. Drain fuel tank after engine preservation and fog interior with preservative oil, type P-10, grade 2, conforming to Specification MIL-L-21260.

h. Exterior Surface. Coat exposed machined ferrous metal surfaces with preservative (P-6) conforming with Specification MIL-C-11796, class 3. If preservative is not available, cup grease may be used.

i. Batteries and Cables. Batteries shall be secured in the battery compartment. Batteries shall be filled and fully charged. Cables shall be disconnected, vent holes sealed, and all terminals wrapped and secured with type III, class 1, pressure-sensitive tape conforming to Specification PPP-T-60.

j. Disassembly, Disassembled Parts, and Basic Issue Items.

- (1) Disassembly shall be limited to the removal of parts and projecting com-

ponents that tend to increase the overall profile of the equipment and that which is subject to pilferage.

- (2) Disassembled items shall be packed with the publications in the toolbox if possible. Otherwise, items will be packed in a suitable container and secured to the equipment to prevent loss or pilferage.

k. *Weatherproofing.* When suitable shelter is not available, select a firm, level, well-drained storage location, protected from prevailing winds. Position the generator set on heavy planking or other solid surfaces. Cover the equipment with a paulin or other suitable waterproof covering and tie down securely.

169. Inspection and Maintenance of Equipment in Storage

a. *Inspection.* When the generator set has

been placed in storage, all scheduled preventive maintenance services, including inspection, will be suspended and preventive maintenance inspection will be performed as specified herein. Refer to AR 743-505.

b. *Worksheet and Preventive Maintenance.* DA Form 464 will be executed on each major item of equipment when initially placed in limited storage and every 30 days thereafter. Required maintenance will be performed promptly to insure that the equipment is mechanically sound and ready for immediate use.

c. *Exercising.* Every 30 days equipment will be inspected as outlined on DA Form 464 and operated long enough to bring it up to its operating temperature and for complete lubrication of gears, bearings, and so on. After each exercising period the equipment will be represerved.

APPENDIX I

REFERENCES

1. Dictionaries of Terms and Abbreviations

AR 320-5 Dictionary of United States Army Terms
AR 320-50 Authorized Abbreviations and Brevity Codes

2. Fire Protection

TM 5-687 Repairs and Utilities: Fire Protection Equipment and Appliances;
Inspections, Operations, and Preventive Maintenance
TM 9-1799 Ordnance Maintenance: Fire Extinguishers

3. Lubrication

LO 5-6115-244-20 Generator Set, Gasoline Engine; 10 Kw, Ac, 120V, 1 and 3 Phase,
120/240V, Single Phase, 120/208V, 3 Phase, 60 Cycle, Skid
Mounted: (Pacific Mercury Model PM59-010-1). W/Continental
Engine Model FS 162-6055

4. Operating Instructions

TM 5-6115-244-10 Operator's Manual Generator Set, Gasoline Engine: 10 Kw, Ac, 120V
1 and 3 Phase, 120/240V Single Phase, 120/208V, 3 Phase, 60 Cycle;
Skid Mounted (Pacific Mercury Model PM59-010-1) Serial Num-
bers 001 through 900, FSN 6115-690-8290

5. Painting and Preservation

TB ENG 60 Preservation and Painting of Serviceable Corps of Engineers Equip-
ment

6. Preventive Maintenance

AR 700-38 Unsatisfactory Equipment Report
AR 750-5 Maintenance Responsibilities and Shop Operation
TB ENG 347 Winterization Techniques for Engineer Equipment
TM 5-505 Maintenance of Engineer Equipment
TM 9-207 Operation and Maintenance of Ordnance Materiel in Extreme Cold
Weather (0 to -65°F.)
TM 9-6140-200-15 Storage Batteries, Lead-Acid Type

7. Publication Indexes

DA Pam 108-1 Index of Army Motion Pictures, Film Strips, Slides, and Phono-
Recordings
DA Pam 310-1 Index of Administrative Publications
DA Pam 310-2 Index of Blank Forms
DA Pam 310-3 Index of Training Publications
DA Pam 310-4 Index of Technical Manuals, Technical Bulletins, Supply Bulletins,
Lubrication Orders, and Modification Work Orders

DA Pam 310-5
DA Pam 310-25

Index of Graphic Training Aids and Devices
Index of Supply Manuals—Corps of Engineers

8. Radio Interference Suppression

TM 11-483

Radio Interference Suppression

9. Shipment and Limited Storage

AR 743-505
TM 38-230

Limited Storage of Engineer Mechanical Equipment
Preservation, Packaging, and Packing of Military Supplies and Equipment

10. Supply Publications

SM 10-1-C4-1
TM 5-6115-244-20P

Petroleum, Petroleum-Base Products, and Related Material
Organizational Maintenance Repair Parts and Special Tool Lists
Generator Set, Gasoline Engine: 10 Kw, Ac, 120V, and 3 Phase, 120/240V Single Phase, 120/208V, 3 Phase, 60 Cycle; Skid Mounted (Pacific Mercury Model PM59-010-1) Serial Numbers 001 through 900, FSN 6115-690-8290

11. Training Aids

FM 21-5
FM 21-6
FM 21-30

Military Training
Techniques of Military Instruction
Military Symbols

APPENDIX II

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

1. General

This appendix contains explanations of all maintenance and repair functions authorized the various echelons. Section II contains the maintenance allocation chart.

2. Maintenance

Maintenance is any action taken to keep materiel in a serviceable condition or to restore it to serviceability when it is unserviceable. Maintenance of materiel includes the following:

a. Service. To clean, preserve, and replenish fuel and lubricants.

b. Adjust. To regulate periodically to prevent malfunction.

c. Inspect. To verify serviceability and detect incipient electrical or mechanical failure by scrutiny.

d. Test. To verify serviceability and detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, and the like.

e. Replace. To substitute serviceable assemblies, subassemblies, and parts for unserviceable components.

f. Repair. To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes, but is not limited to, inspecting, cleaning, preserving, adjusting, replacing, welding, riveting, and straightening.

g. Aline. To adjust two or more components of an electrical system so that their functions are properly synchronized.

h. Calibrate. To determine, check, or rectify the graduation of an instrument, weapon, or weapons system, or components of a weapons system.

i. Overhaul. To restore an item to completely serviceable condition as prescribed by serviceability standards developed and published by heads of technical services. This is accomplished through employment of the technique of "inspect and repair only as necessary" (IROAN). Maximum utilization of diagnostic and test equipment is combined with minimum disassembly of the item during the overhaul process.

3. Explanation of Columns

a. Functional Group. The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes (obtained from the Corps of Engineers functional grouping indexes) are listed on the MAC in the appropriate numerical sequence. These indexes are normally set up in accordance with their function and proximity to each other.

b. Components and Related Operation. This column contains the functional grouping index heading, subgroup headings, and a brief description of the part starting with the noun name. It also designates the operations to be performed such as service, adjust, inspect, test, replace, repair, and overhaul.

c. Echelons of Maintenance. This column contains the various echelons of maintenance by number designation. An X placed in the appropriate echelon column in line with an indicated maintenance function authorizes that echelon to perform the function. The X indicates the lowest echelon responsible for performing the function, but does not necessarily indicate repair parts stockage at that level. Higher echelons are authorized to perform the indicated functions of lower echelons.

d. *Remarks.* This column lists specific maintenance functions, special tools, cross-references, instructions, and the like pertinent to the operation being performed.

Section II. MAINTENANCE ALLOCATION CHART

Functional group	Components and related operation	Echelons of maintenance					Remarks
		1	2	3	4	5	
01	ENGINE						
0100	ENGINE ASSEMBLY						
	Engine, Gasoline:						
	Service.....	X					
	Inspect.....	X					
	Test.....		X				Compression.
	Replace.....			X			
	Repair.....			X			
	Overhaul.....				X		
0101	CRANKCASE, BLOCK, CYLINDER						
	HEAD						
	Head, Cylinder:						
	Replace.....		X				
	Gasket:						
	Replace.....		X				
	Plug, Expansion:						
	Replace.....		X				
0102	CRANKSHAFT						
	Crankshaft Assembly:						
	Replace.....				X		
	Repair.....					X	Resize, align.
	Bearing, Sleeve:						
	Replace.....				X		
	Seal, Plain Encased:						
	Replace.....				X		
	Washer, Thrust:						
	Replace.....				X		
0103	FLYWHEEL ASSEMBLY						
	Flywheel Assembly:						
	Repair.....				X		Install ring gear.
0104	PISTONS, CONNECTIONS RODS						
	Bearing, Sleeve:						
	Replace.....				X		
	Piston, Internal Combustion Engine:						
	Replace.....				X		
	Repair.....				X		
	Rod Assembly, Connecting:						
	Replace.....				X		
	Repair.....				X		
0105.1	VALVES						
	Valve, Poppet Engine:						
	Replace.....			X			
	Repair.....			X			Reface.
	Guide, Valve Stem:						
	Replace.....			X			
	Spring, Helical Compression:						
	Replace.....			X			
	Insert, Valve Seat:						
	Replace.....			X			
	Repair.....			X			Grind seat.
	Cap, Valve Stem:						
	Replace.....			X			

Functional group	Components and related operation	Echelons of maintenance					Remarks
		1	2	3	4	5	
0105.2	ROCKER ARMS, TAPPETS Gasket, Valve Chamber Cover: Replace-----		X				
0105.3	CAMSHAFTS Camshaft: Replace----- Bearing, Camshaft: Replace----- Washer, Thrust: Replace-----				X X X		
0105.5	TIMING GEARS Gear, Helical: Replace-----				X		
0106.1	OIL PUMP Pump Assembly, Oil: Replace----- Repair-----			X X			Install kit.
0106.2	OIL FILTERS Filter, Oil: Service-----	X					Replace element.
0106.4	PRESSURE REGULATOR OR RELIEF VALVES Valve, Safety Relief, Oil Pressure: Replace----- Spring, Helical Compression: Replace-----		X X				
0106.6	OIL PAN, LINES, LEVEL GAGE Tubes, Oil: Replace----- Cap, Oil Fill: Replace-----		X X				
0108	MANIFOLDS Manifold, Exhaust and Intake: Replace----- Gasket: Replace-----		X X				
0111.1	HAND CRANKING DEVICES Handcrank: Replace----- Clip, Handcrank Retaining: Replace-----		X X				
03	FUEL SYSTEM						
0301	CARBURETOR Carburetor: Adjust----- Service----- Replace-----		X X X				Clean, replace bowl gasket.
0302.4	FUEL PUMP, GASOLINE Pump, Fuel Service----- Replace-----	X					Clean screen.
0304	AIR CLEANER Cleaner Assembly, Air: Service----- Hose, Air Cleaner-to-Carburetor: Replace-----	X	X				

Functional group	Components and related operation	Echelons of maintenance					Remarks
		1	2	3	4	5	
0306	TANKS, LINES, FITTINGS						
	Tank, Fuel:						
	Service.....	X					
	Repair.....			X			
	Cap, Fuel Tank:						
	Replace.....		X				Chained.
	Valve, Three-way:						
	Replace.....		X				
	Lines, Fuel:						
	Replace.....		X				Fabricate.
0308	ENGINE SPEED GOVERNOR						
	Governor, Engine Speed:						
	Adjust.....		X				
	Replace.....			X			
	Repair.....				X		
	Rod, Governor Control:						
	Adjust.....		X				
0309	FUEL FILTERS						
	Filter:						
	Service.....	X					Clean bowl and element.
	Replace.....		X				
0311	PRIMING SYSTEM						
	Pump, Engine Primer:						
	Replace.....		X				
	Repair.....		X				
	Tube, Primer Fuel:						
	Replace.....		X				Fabricate.
0312	ACCELERATOR, THROTTLE OR CHOKE CONTROLS						
	Choke, Carburetor Automatic:						
	Adjust.....		X				
04	EXHAUST SYSTEM						
0401	MUFFLER AND PIPES						
	Muffler, Exhaust:						
	Replace.....		X				
05	COOLING SYSTEM						
0501	RADIATOR						
	Radiator:						
	Service.....	X					
	Replace.....			X			
	Repair.....			X			
	Cap, Radiator:						
	Replace.....	X					
	Shutter and Controls:						
	Repair.....		X				
	Rod, Shutter Control:						
	Replace.....		X				
	Repair.....		X				
	Thermostat, Shutter Control:						
	Replace.....		X				
0503	LINES AND FITTINGS, HOSES, PIPES, CLAMPS						
	Hose, Rubber:						
	Replace.....		X				
	Valve, Angle:						
	Replace.....		X				

Functional group	Components and related operation	Echelons of maintenance					Remarks
		1	2	3	4	5	
0504	Tube, Bypass:						
	Replace-----		X				Fabricate.
	Hose, Drain:						
	Replace-----		X				Fabricate.
0505	WATER PUMP						
	Pump, Water:						
0506	Replace-----			X			
	FAN ASSEMBLY						
0506	Fan:						
	Replace-----			X			
06	WATER MANIFOLDS, HEADERS, THERMOSTATS AND HOUSINGS, GASKETS						
	Thermostat, Flow Control:						
	Test-----		X				
	Replace-----		X				
0601	Gasket:						
	Replace-----		X				
	ELECTRICAL SYSTEM (ENGINE AND VEHICULAR)						
	GENERATOR						
0602	Generator Assembly:						
	Service-----	X					
	Test-----		X				On engine.
	Replace-----		X				
0603	Repair-----			X			Install kit.
	Belt:						
	Adjust-----	X					
	Replace-----		X				
0604.2	Brush, Electrical Contact:						
	Replace-----		X				
	GENERATOR REGULATOR						
	Regulator, Engine Generator:						
0604.6	Adjust-----		X				
	Test-----		X				
	Replace-----		X				
	STARTER						
0604.2	Starter Assembly:						
	Test-----		X				
	Replace-----		X				
	Repair-----			X			Install kit.
0604.6	Relay, Solenoid:						
	Replace-----		X				
	Switch, Solenoid:						
	Replace-----		X				
0604.6	MAGNETO						
	Magneto, Ignition:						
	Adjust-----		X				
	Replace-----		X				
0604.6	Repair-----			X			Install kit.
	Contact Set and Capacitor:						
	Replace-----		X				
	WIRING, SPARK PLUGS						
0604.6	Plug, Spark:						
	Service-----		X				
	Adjust-----		X				
	Replace-----		X				

Functional group	Components and related operation	Echelons of maintenance					Remarks
		1	2	3	4	5	
0606	Wire, Spark Plug:						
	Replace.....		X				
	ENGINE CONTROLS						
	Switch, Oil Pressure:						
0607	Replace.....		X				
	Relay, Safety:						
	Replace.....		X				
	INSTRUMENT OF ENGINE CONTROL PANEL						
0612	Switch, Start and Stop:						
	Replace.....		X				
	Meter, Time-Totalizing:						
	Replace.....		X				
0615	Ammeter:						
	Replace.....		X				
	Light, Control Panel:						
	Replace.....		X				
0612	Lamp, Incandescent:						
	Replace.....	X					
	BATTERIES						
	Battery, 12-Volt:						
0615	Service.....	X					
	Test.....		X				
	Replace.....	X					
	Cable, Battery:						
0615	Replace.....		X				
	RADIO SUPPRESSION						
	Capacitor, Fixed Paper Dielectric:						
	Replace.....		X				
15	FRAME						
1501	FRAME ASSEMBLY						
	Skid Assembly, Generator:						
	Replace.....				X		
	Frame, Lifting:						
1503	Replace.....			X			
	Frame, Front and Rear:						
	Replace.....			X			
	Eye Assembly, Lifting:						
1708	Replace.....		X				
	PINTLES AND TOWING ATTACHMENTS						
	Eye, Towing:						
	Replace.....		X				
17	BODY; CAB; HOOD; HULL						
2207	STOWAGE RACKS, BOXES, STRAPS						
	Toolbox:						
	Replace.....		X				
	MISCELLANEOUS BODY, CHASSIS OR HULL, AND ACCESSORY ITEMS						
2207	WINTERIZATION EQUIPMENT						
	Valve, Angle:						
	Replace.....		X				
	Hose, Flexible Exhaust:						
	Replace.....		X				
	Hose, Drain:						
	Replace.....		X				

Functional group	Components and related operation	Echelons of maintenance					Remarks
		1	2	3	4	5	
2210	Tube Assembly, Coolant:						
	Replace.....		X				
	Valve, Drain:						
	Replace.....		X				
41	DATA PLATES AND INSTRUCTION						
	HOLDERS						
	Plate, Instruction:						
	Replace.....		X				
4100	Plate, Data (C.O.E.):						
	Replace.....			X			
	ELECTRIC GENERATORS						
	GENERATOR ASSEMBLY						
4100.1	Generator Assembly, AC:						
	Inspect.....		X				
	Test.....			X			
	Replace.....			X			
4100.1	Repair.....			X			
	Overhaul.....				X		
	ROTOR ASSEMBLIES						
	Rotor, Generator:						
4100.2	Test.....				X		
	Replace.....				X		
	Repair.....				X		
	Overhaul.....					X	
4100.2	STATOR ASSEMBLIES						
	Stator, Generator:						
	Test.....				X		
	Replace.....				X		
4100.3	Repair.....				X		
	Overhaul.....					X	
	BRUSH HOLDERS						
	Brush, Electrical Contact:						
4100.4	Replace.....		X				
	Holder, Brush:						
	Adjust.....			X			
	Replace.....			X			
4100.4	Stud, Brush Holder:						
	Replace.....			X			
	Ring, Electrical Brush Holder:						
	Replace.....			X			
4100.5	VENTILATING SYSTEM						
	Fan, Electrical Rotating Equipment:						
	Replace.....			X			
	Cover and Screen:						
4100.5	Replace.....		X				
	FRAME SUPPORTS AND HOUSINGS						
	Bearing, Ball Annular:						
	Replace.....				X		
4100.6	Retainer, Rotor Hub Bearing:						
	Replace.....				X		
	DRIVE COMPONENTS						
	Disk, Coupling:						
4100.6	Replace.....			X			
	Hub, Coupling:						
	Replace.....				X		
	Replace.....						

Functional group	Components and related operation	Echelons of maintenance					Remarks
		1	2	3	4	5	
4100.7	CONTROL PANELS, HOUSINGS, CUBICLES						
	Ac Ammeter:						
	Replace.....		X				
	Receptacles:						
	Replace.....		X				
	Panel, Control:						
	Replace.....			X			
	Light, Power On:						
	Replace.....		X				
	Ac Voltmeter:						
	Replace.....		X				
	Meter, Frequency:						
	Replace.....		X				
	Wiring, Electrical:						
	Replace.....			X			
	Lamp, Incandescent:						
	Replace.....	X					
4100.9	CIRCUIT BREAKER ASSEMBLY						
	Contact, Electrical:						
	Replace.....			X			
	Repair.....			X			
	Circuit Breaker:						
	Replace.....			X			
4100.10	SWITCHES						
	Switch, Toggle:						
	Replace.....		X				
	Switch, Rotary:						
	Replace.....		X				
4100.11	REGULATOR; VOLTAGE OR CURRENT						
	Regulator, Voltage:						
	Adjust.....			X			
	Replace.....			X			
	Control Element:						
	Replace.....			X			
4100.12	RESISTORS						
	Resistor, Variable:						
	Replace.....			X			
	Rheostat, Adjustable:						
	Replace.....			X			
4100.13	RELAY OR ASSEMBLY						
	Relay:						
	Replace.....			X			
4100.14	FUSE AND FUSE HOLDER						
	Fuse, 15-amp:						
	Replace.....	X					
	Holder, Fuse:						
	Replace.....		X				
4100.16	TRANSFORMERS; RECTIFIERS						
	Transformer, Current:						
	Replace.....			X			
4100.17	TERMINAL BLOCK; JUNCTION BOXES						
	Board Assembly, Load Terminal:						
	Replace.....		X				
	Board Assembly, Changeover:						
	Replace.....		X				
	Strip, Terminal:						
	Replace.....			X			

Functional group	Components and related operation	Echeions of maintenance					Remarks
		1	2	3	4	5	
4100.18	HOUSING OR HULL PANELS AND ATTACHING PARTS Panels: Replace..... Door, Access: Replace..... Latch Assembly: Replace..... Top Cowl: Replace.....		X				
4100.19	RADIO INTERFERENCE SUPPRESSION Capacitors: Replace..... Ground Strap: Replace.....		X				
4106.2	STATOR ASSEMBLY Exciter Frame and Bracket: Test..... Replace..... Repair..... Overhaul.....		X		X X X	X	
4106.3	BRUSH HOLDERS Brush, Electrical Contact: Replace..... Holder, Electrical Brush: Replace..... Spring, Tension: Test..... Adjust..... Replace.....		X	X			
47	GAGES (NONELECTRICAL); WEIGHING AND MEASURING DEVICES			X			
4703.1	OIL PRESSURE GAGES Tube, Copper: Replace.....		X				Fabricate.
4705	FUEL GAGES Gage, Liquid, Float Type: Replace.....		X				
4708	TEMPERATURE GAGES Thermometer, Indicating: Replace.....		X				
60	STEAM BOILERS; WATER HEATERS; HEATING UNITS; BURNERS						
6000.3	ENGINE OR EQUIPMENT HEATERS Heater, Winterization: Test..... Replace..... Repair..... Overhaul..... Igniter Assembly: Replace..... Rope, Manual Igniting: Replace..... Lead, Electrical: Replace..... Exchanger Assembly, Heat: Replace.....		X X X		X X		Bench test.

Functional group	Components and related operation	Echelons of maintenance					Remarks
		1	2	3	4	5	
76 7603	Housing: Replace-----				X		
	Resistor, Fixed: Test-----		X				
	Replace-----		X				
	Thermostat, Overheat Temperature: Replace-----		X				
	Valve, Solenoid: Test-----		X				
	Replace-----		X				
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Thermostat, shutter control.....	114	60	Smokes excessively upon	42	16
Field expedient repair.....	114g	61	starting.		
Testing.....	114d	61	Tube, coolant bypass.....	117	63
Thermostatic switch.....	161	76	Tube leaks, fuel.....	46	17
Three-way fuel valve, heater.....	77	29	Tubes, fuel.....	79	32
Three-way fuel valve, main tank.....	78	30	Field expedient repair.....	79d	32
Throttle control.....	87	37	Tubes, heater coolant.....	118	64
Time-totalizing meter.....	139	72	Tubes, oil.....	94	41
Timing hole cover.....	125	67	Tubes, primer fuel.....	85	35
Timing magneto.....	100c	45	Unloading the equipment.....	6	6
Toolbox.....	71	26	Unpacking the equipment.....	7	6
Tools, special.....	13	9	Valve adjustment.....	128	68
Top cowl.....	60	21	Valve chamber cover.....	127	68
Torque data, nut and bolt.....	4b	2	Valve, heater three-way fuel.....	77	29
Towing eyes.....	70	25	Valve, main tank three-way fuel.....	78	30
Troubleshooting:			Valve, oil drain.....	96	41
Alternating current ammeter fails	39	16	Valves and tubes, heater coolant.....	118	64
to register.			Ventilating screens and dust cover.....	159	75
Alternating current voltmeter	38	16	Ventilating shroud and endbell cover.....	157	75
fails to register.			Voltage adjustment switch.....	153	74
Battery charging ammeter indicates:			Voltmeter, alternating current.....	141	72
Charge when batteries are fully	30	15	Voltmeter (alternating current) fails	38	16
charged.			to register.		
Low or no charging rate when bat-	29	15	Water temperature indicating	132	70
teries are low or discharged.			thermometer.		
Engine:			Winterization system:		
Exhaust smoke excessive.....	26	14	Draincock and fittings.....	163	78
Fails to start or is hard to	18	13	Exhaust hoses.....	162	78
start.			General.....	160	76
Fails to stop.....	21	14	Hoses, exhaust.....	162	78
Has low or no oil pressure.....	25	14	Thermostatic switch.....	161	76
Lacks power.....	23	14	Winterization heater.....	4b, 164	2, 78
Misses or runs erratically.....	19	13	Testing and adjustment.....	164b	78
Noisy.....	24	14	Winterization heater mounting	165	83
Oil consumption high.....	27	15	brackets.		
Overheats.....	22	14	Wire brackets, spark plug.....	98	42
Stops suddenly.....	20	14	Wires, spark plug.....	98	42
Engine generator overheats.....	31	15	Wiring.....	130	69
Frequency meter fails to register.....	37	16	Testing.....	130c	69
General.....	17	13	Wiring diagram.....	4b	2
Main generator:					
Delivers erratic voltage.....	34	15			

BY ORDER OF THE SECRETARY OF THE ARMY:

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:

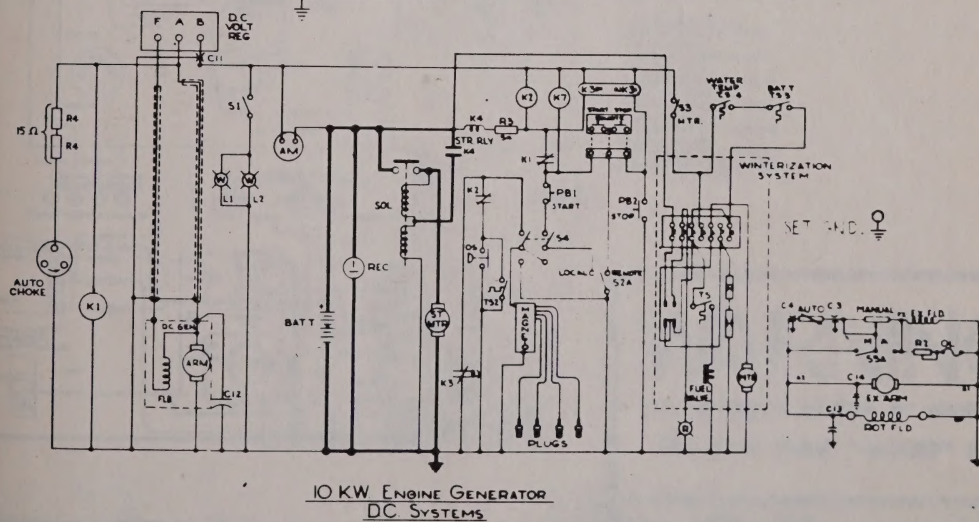
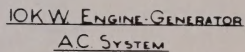
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

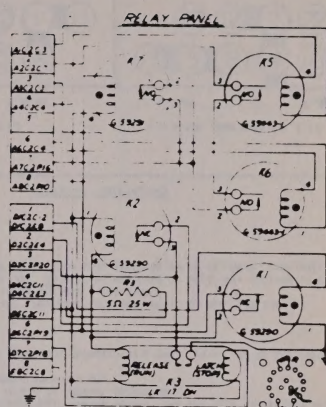
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☆ U. S. GOVERNMENT PRINTING OFFICE: 1962-810807

CHANGE BOARD





10 KW ENG GEN WIRING LAYOUT

Wire Code

CODE IDENTIFIES TYPE OF WIRE
AND TERMINATION POINTS OF
EACH WIRE.

- A. AC SYSTEM
- B BATTERY BOX
- C CONTROL CABINET
- D. DC SYSTEM
- E ENGINE AREA
- F. FRAME (GROUND)
- G. GENERATOR SYSTEM
- I INSTRUMENT PANEL
- L LOAD TERMINALS
- P CONTROL CAB PANEL
- R REMOTE CONT TERMINALS
- W WINTERIZATION
- X AUXILIARY POWER

- **PREFIX LETTER**
(ELECTRICAL SYSTEM)
- 1st NUMBER
(WIRE OR TERMINAL NO.)
- 2nd LETTER
(COMPONENT LOCATION)
- 3rd NUMBER
(COMPONENT NUMBER)
- 4th LETTER
(COMPONENT LOCATION)
- 5th NUMBER
(COMPONENT NUMBER)
- (1)(2) ETC. = WIRE TERMINATING LOCATION.

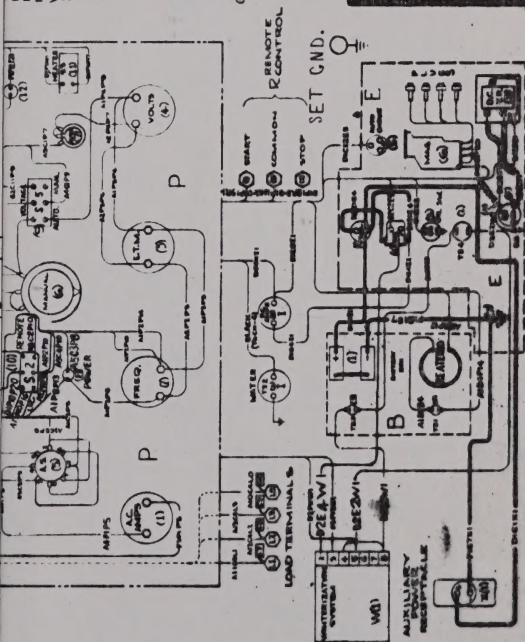
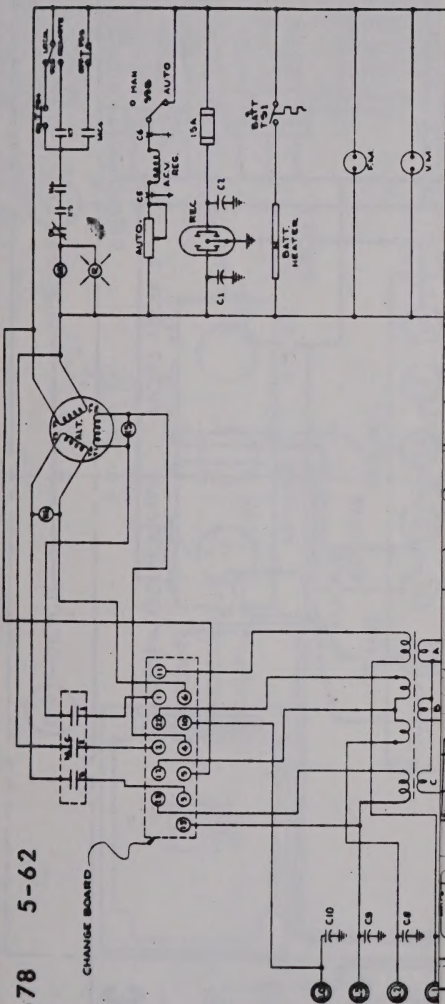
(1)(2) ETC. - WIRE TERMINATING LOCATION.

WARNING!

**AVOID SHOCK HAZARD BY GROUNDING
SET WITH FRAME "GROUND" STUD.**

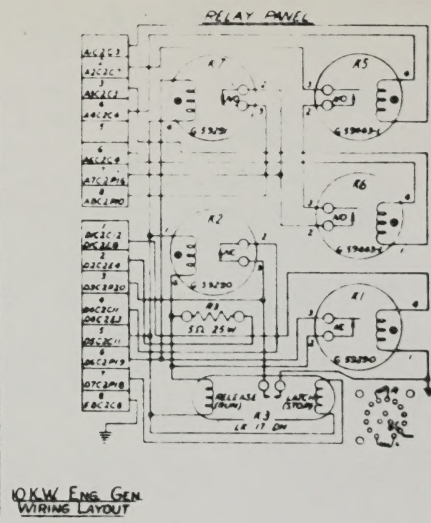
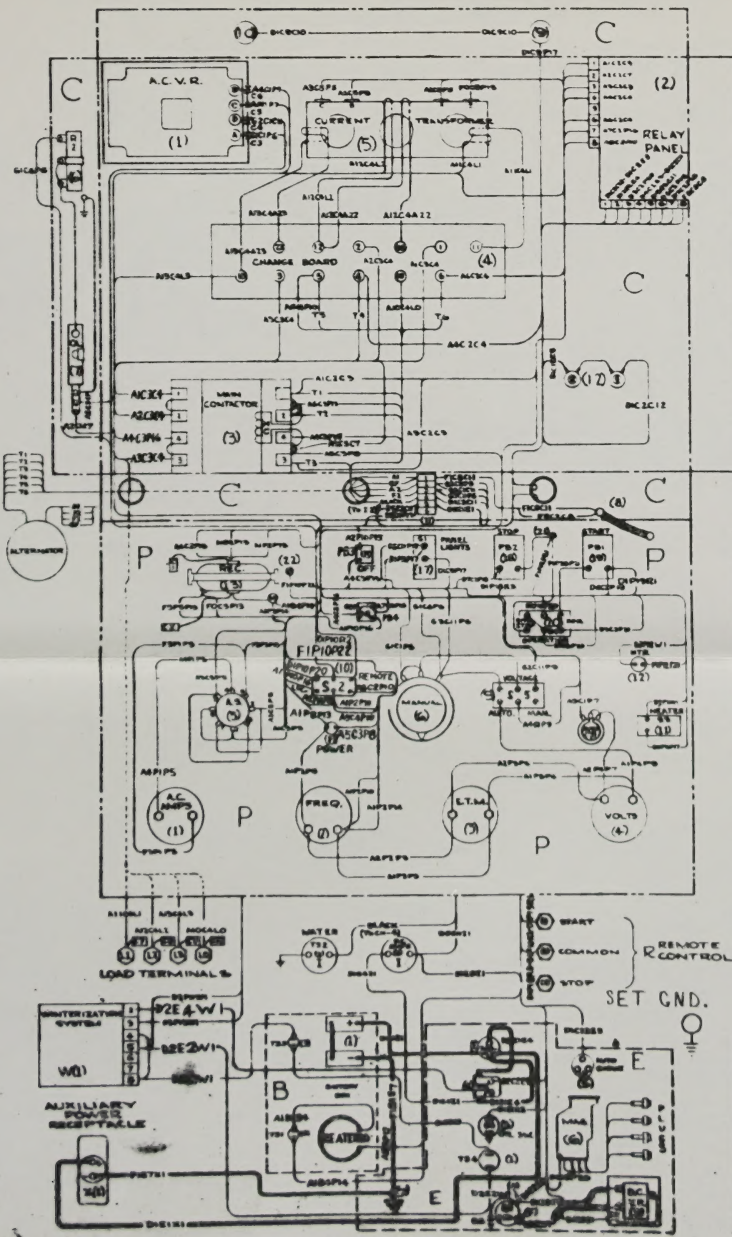
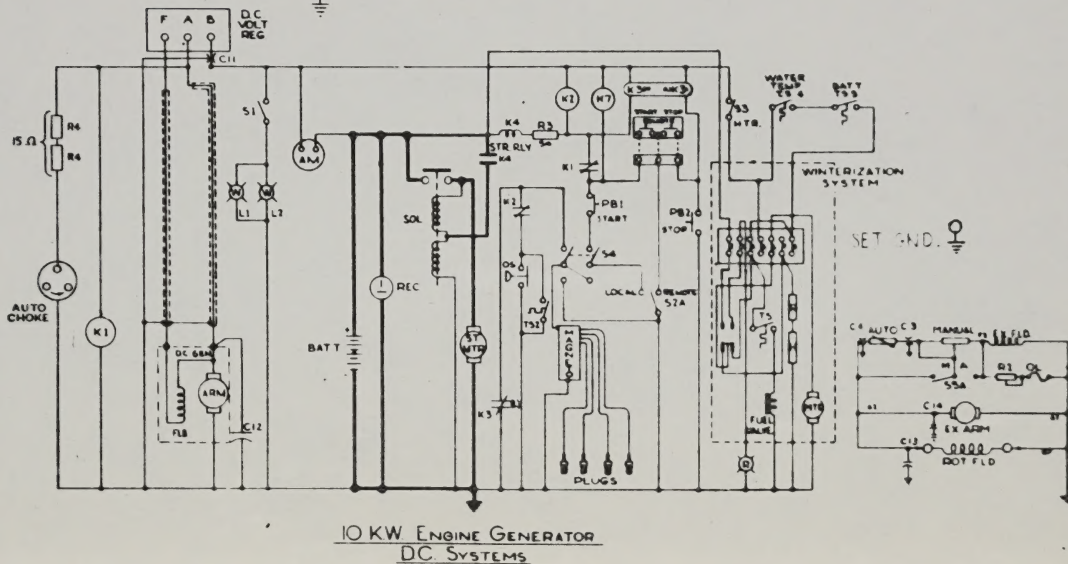
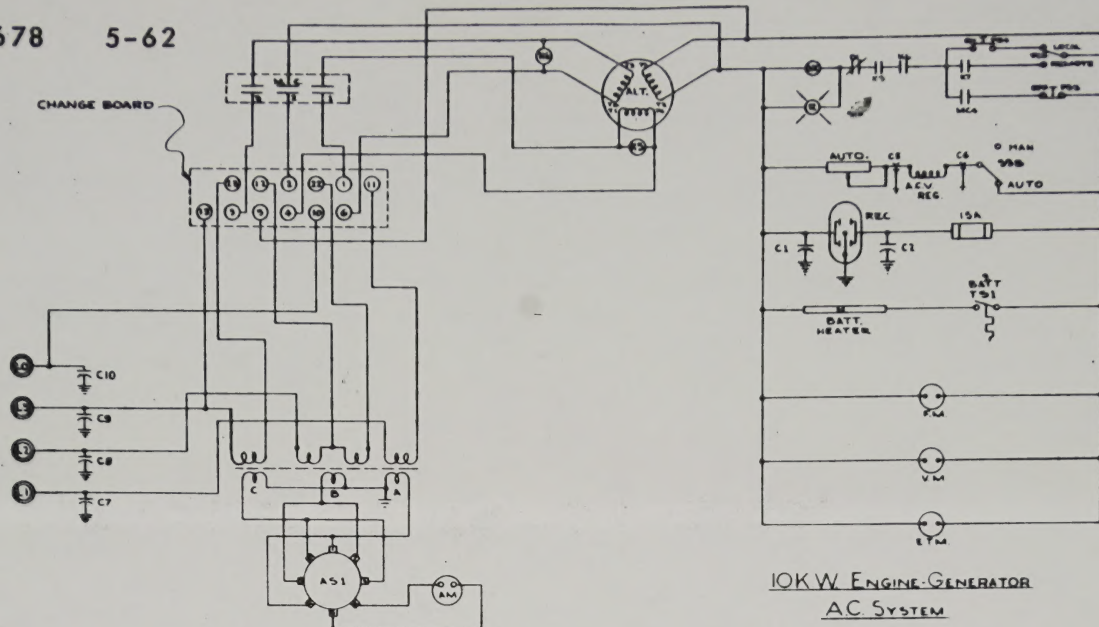
MAJ AMP-104

1. THE GENERATOR GROUPODS DO NOT REQUIRE LUBRICATION AS SEALED LUBRICATED BEARINGS ARE USED.
2. CONTROL VALVES AND LATCHES MAY BE LUBRICATED WITH A FEW DROPS OF LIGHT MACHINE OIL.
3. APPLY SEVERAL DROPS OF ENGINE OIL TO THE CARBURETOR LINKAGE AND GOVERNOR LINKAGE POINTS.
4. THE FOLLOWING LUBRICANTS ARE RECOMMENDED FOR USE UNDER THE LISTED TEMPERATURE RANGES:
 - a. -65°F. TO 0°F. MIL-0-10295 OIL-ENGINE SUB ZERO.
 - b. 0°F. TO 32°F. MIL-0-2104 OIL-ENGINE, HEAVY DUTY GRADE SAE 70.
 - c. ABOVE PLUS 32°F. MIL-0-2104 OIL-ENGINE HEAVY DUTY GRADE SAE 90.



- **LOAD TERMINALS**
 - CONTROL CABLE PANEL
 - REMOTE CONTROL TERMINALS
 - WINTERIZATION
 - AUXILIARY POWER
- **PREFIX LETTERS**
 - (ELECTRICAL SYSTEM)
 - (NUMERICAL SYSTEM)
 - (WIRE OR TERMINAL NO.)
 - (2ND LETTER)
 - (COMPONENT LOCATION)
 - (2ND NUMBER)
 - (COMPONENT NUMBER)
 - (3RD LETTER)
 - (COMPONENT LOCATION)
 - (2ND NUMBER)
 - (COMPONENT NUMBER)
 - (3RD LETTER)
 - (3RD) ETC. - WIRE TERMINATING LOCATION.

WARNING!
AVOID SHOCK HAZARD BY GROUNDING
SET WITH FRAME "GROUND" STUD.

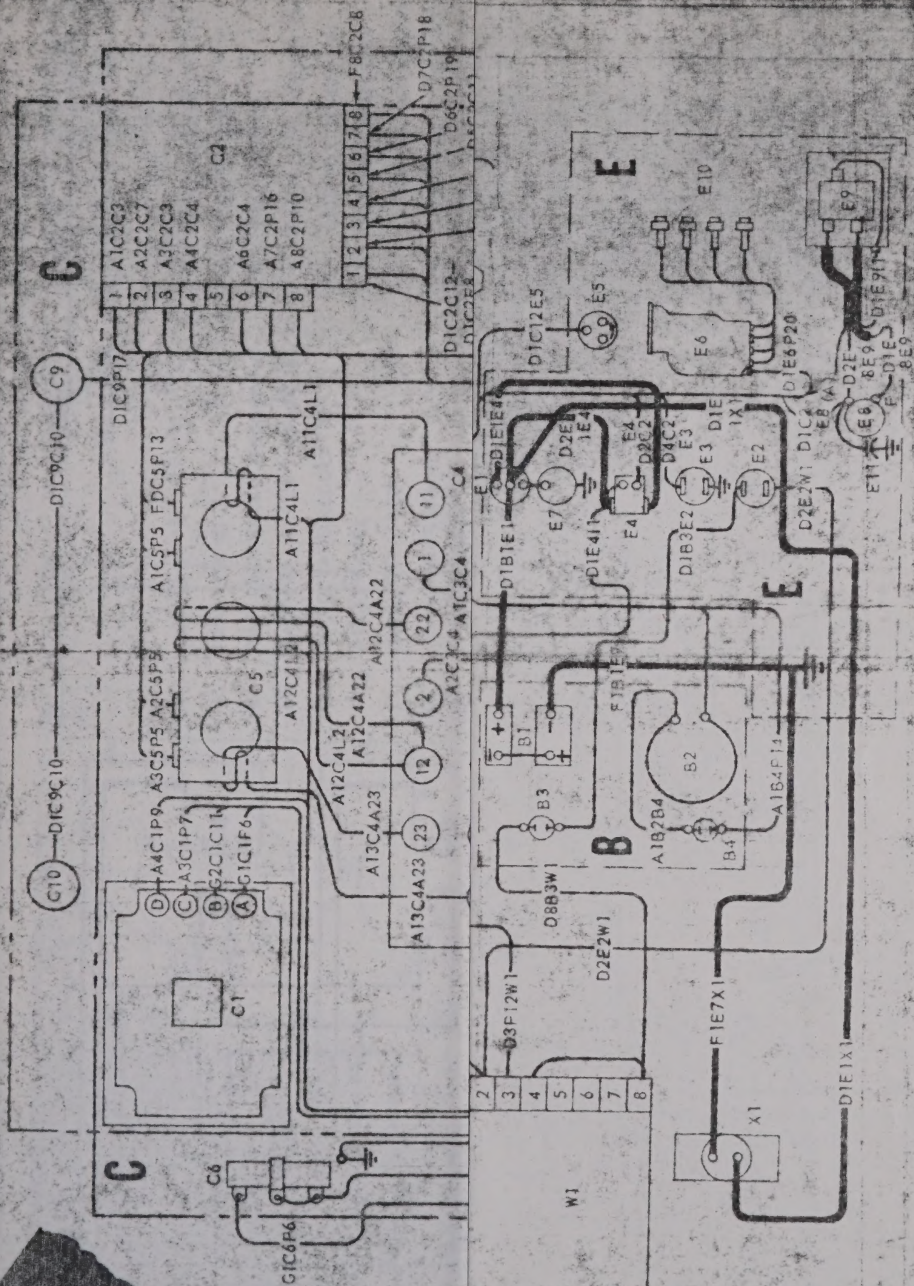


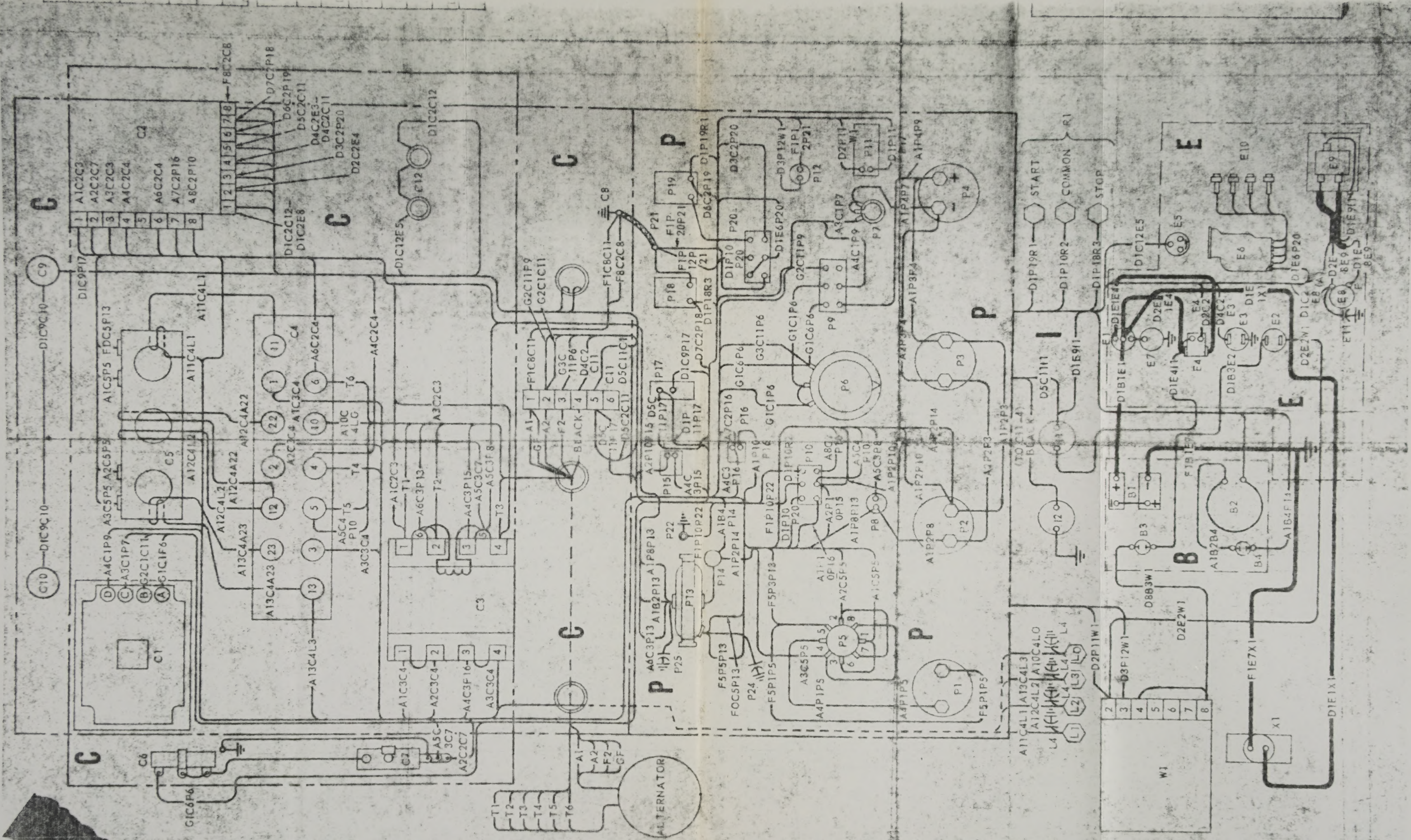
WIRE CODE
 CODE IDENTIFIES TYPE OF WIRE
 AND TERMINAL POINTS OF EACH WIRE

A-AC SYSTEM
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 E-ENGINE AREA
 F-FRAME (GROUND)
 G-GENERATOR SYSTEM
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 L-LOAD TERMINALS
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 R-REMOTE CONT. TERMINALS
 W-WINTERIZATION
 X-AUXILIARY POWER

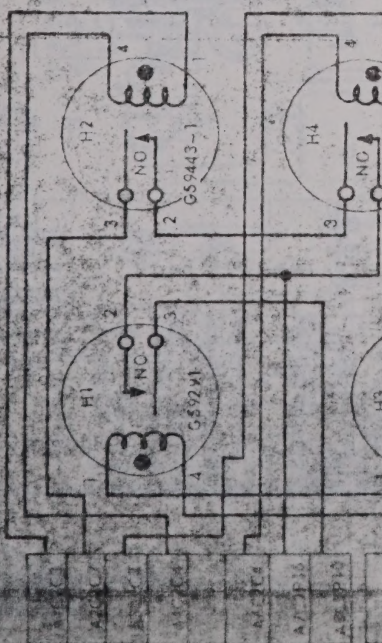
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 (1)(2) ETC. - WIRE TERMINATING LOCATION.

WARNING!
 AVOID SHOCK HAZARD BY GROUNDING
 SET WITH FRAME "GROUND" STUD.





RELAY PANEL



NORMALLY OPEN CONTACT
NORMALLY CLOSED CONTACT

RESISTOR

GROUND

CAPACITOR

ALTERNATING CURRENT

DIRECT CURRENT

NEGATIVE POLARITY

POSITIVE POLARITY

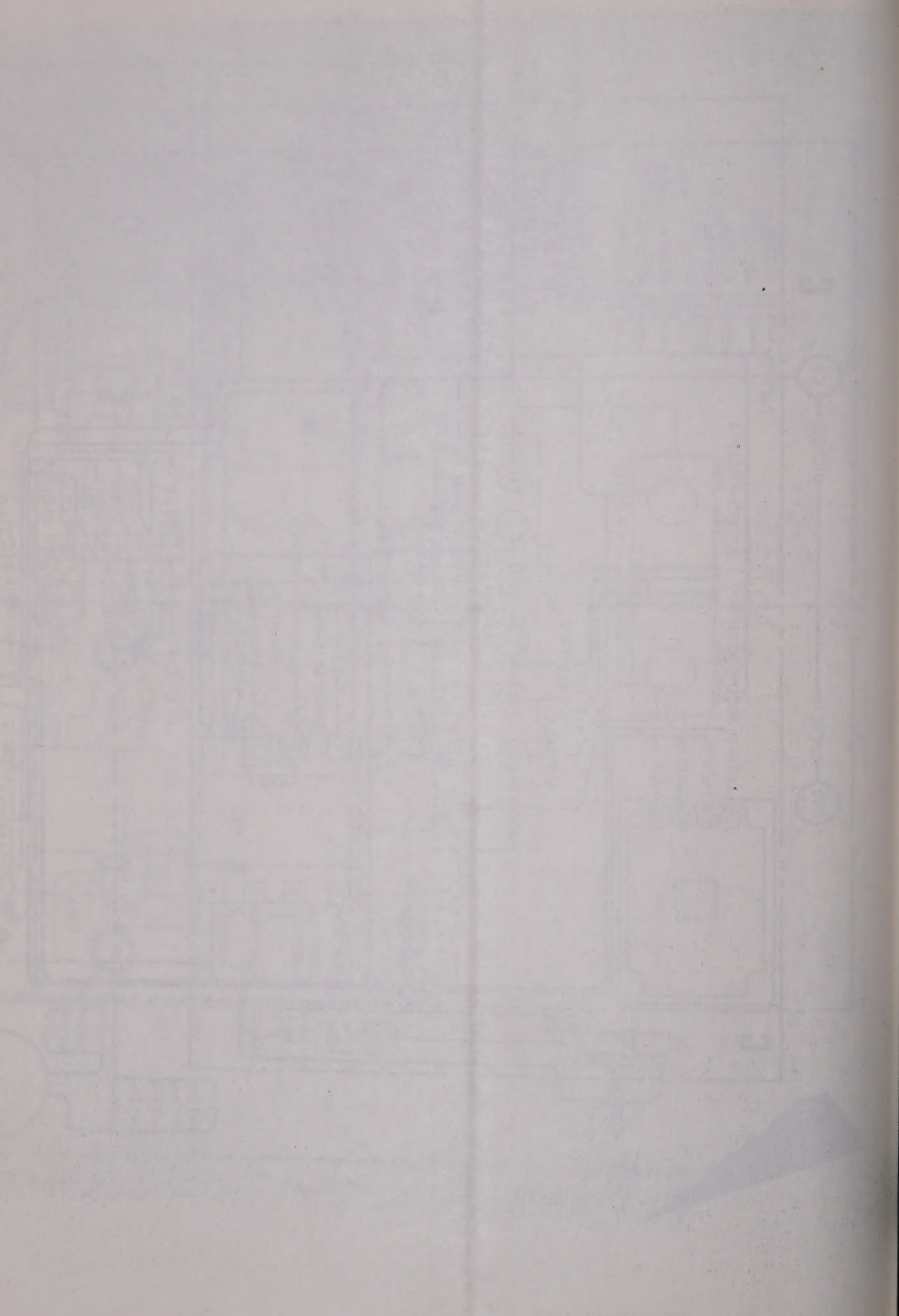
VOLT

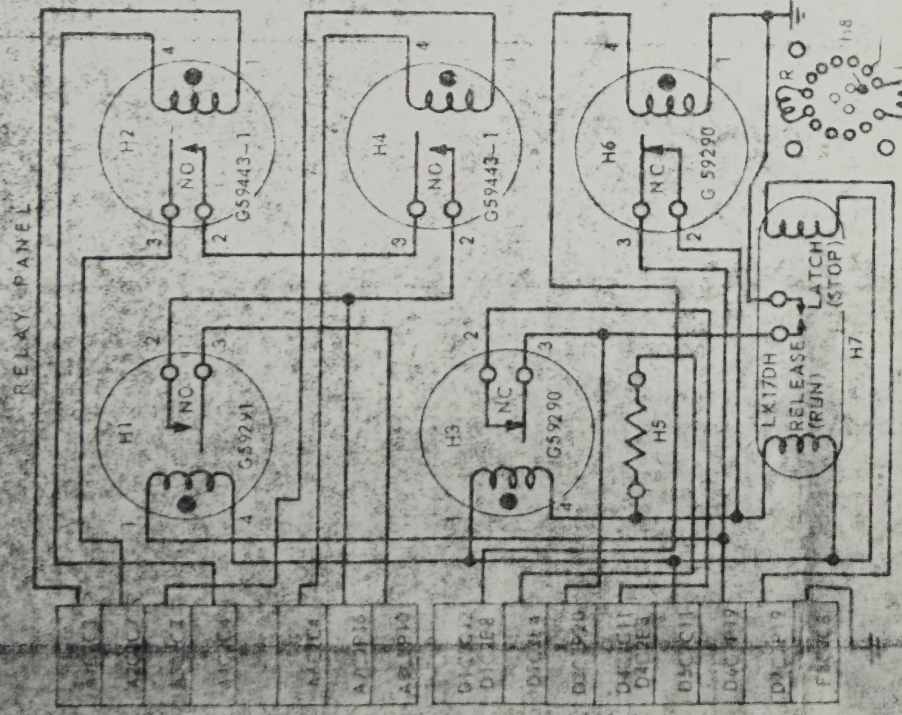
DEVICE LEGEND

- | | | | |
|----|---------------------------|-----|--------------------------------|
| B1 | BATTERIES | P17 | PANEL LIGHTS SWITCH |
| B2 | HEATER WINDING | P18 | STOP SWITCH |
| B3 | BATTERY HEATER THERMOSTAT | P19 | START SWITCH |
| B4 | BATTERY HEATER THERMOSTAT | P20 | EMERGENCY OPERATION SWITCH |
| C1 | AC VOLTAGE REGULATOR | P21 | GROUND CONNECTION |
| C2 | RELAY PANEL | P22 | GROUND CONNECTION |
| C3 | MAIN CONTACTOR | P23 | CAPACITOR, 0.1-UF, 500-V AC/DC |
| C4 | CHANGEOVER BOARD | P24 | CAPACITOR, 0.1-UF, 500-V AC/DC |

- | | |
|-----|--|
| P5 | AC AMMETER SWITCH |
| P6 | MANUAL RHEOSTAT, 25-OHMS, 150-WATTS |
| P7 | AUTOMATIC RHEOSTAT, 250-OHMS, 25-WATTS |
| P8 | POWER ON LIGHT |
| P9 | VOLTAGE REGULATOR SWITCH |
| P10 | REMOTE-LOCAL SWITCH |
| P11 | HEATER SWITCH |
| P12 | HEATER PILOT LIGHT |
| P13 | RECEPTACLE |
| P14 | FUSE, 5-AMPERE |
| P15 | MAIN CONTACTOR OFF SWITCH |
| P16 | MAIN CONTACTOR ON SWITCH |

Practical wiring diagram.





WIRE CODE
CODE IDENTIFIES TYPE OF USE AND
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- A* AC SYSTEM
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- C CONTROL CABINET
- D* DC SYSTEM
- E ENGINE AREA
- F* FRAME (GROUND)
- G* GENERATOR SYSTEM
- I INSTRUMENT PANEL
- L LOAD TERMINALS
- P CONTROL CABINET PANEL
- R REMOTE CONTROL TERMINALS
- W WINTERIZATION CIRCUIT
- X BATTERY-CHARGING CONNECTOR

- PREFIX LETTER
(ELECTRICAL SYSTEM)
- 1ST. NUMBER
(WIRE OR TERMINAL NO.)
- 2ND LETTER
(COMPONENT LOCATION)
- 3RD NUMBER
(COMPONENT NUMBER)
- 3RD LETTER
(SAME AS 2ND LETTER)
- 3RD NUMBER
(SAME AS 2ND NUMBER)
- 1-2 ETC. - WIRE TERMINATING LOCATION

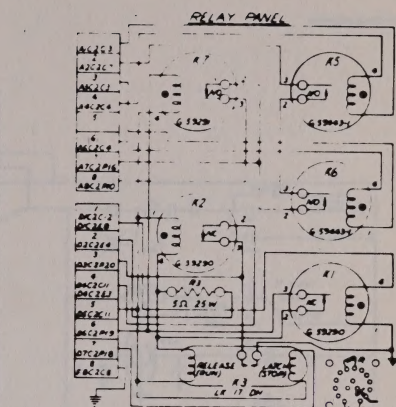
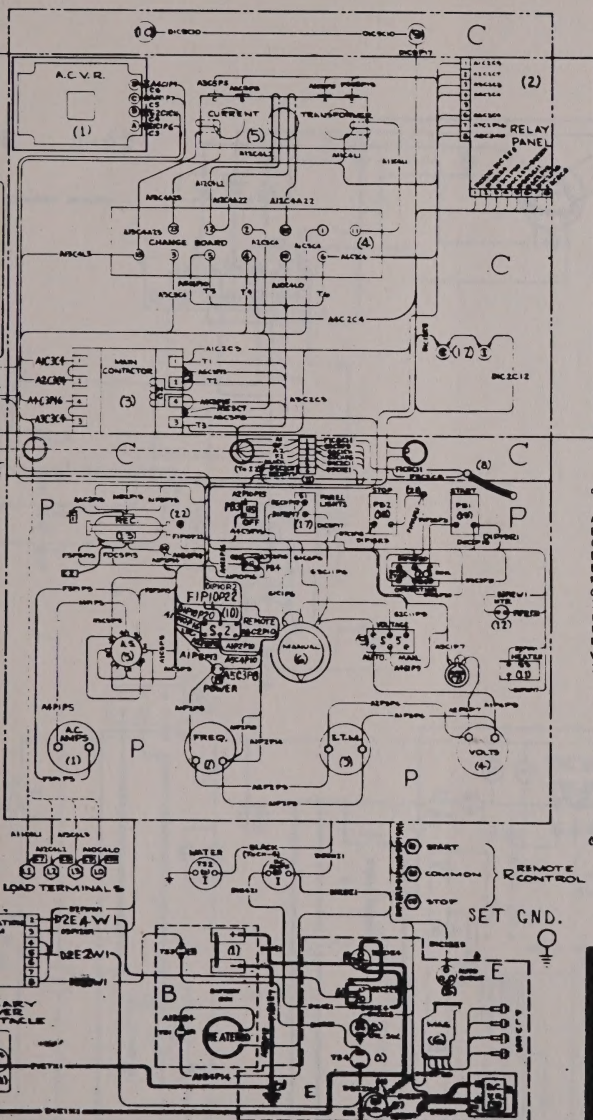
SYMBOL LEGEND

- COIL OR RELAY
- NORMALLY OPEN CONTACT
- NORMALLY CLOSED CONTACT
- RESISTOR
- GROUND
- CAPACITOR
- ALTERNATING CURRENT
- DIRECT CURRENT
- NEGATIVE POLARITY
- POSITIVE POLARITY
- VOLT

DEVICE LEGEND

- B1 BATTERIES
- B2 HEATING
- B3 BATTERY HEATER THERMOSTAT
- B4 BATTERY HEATER THERMOSTAT
- C1 AC VOLTAGE REGULATOR
- C2 RELAY PANEL
- C3 MAIN CONTACTOR
- C4 CHANGEOVER BOARD
- C5 CURRENT TRANSFORMER
- C6 RESISTOR, 150-OHMS, 50-WATTS
- C7 OVERLOAD SWITCH
- C8 GROUNDING TERMINAL
- C9 PANEL LIGHT
- C10 PANEL LIGHT
- C11 TERMINAL STRIP
- C12 RESISTOR, 7.5-OHMS, 25-WATTS
- E1 SOLENOID RELAY
- E2 COOLANT THERMOSTATIC SWITCH
- E3 OIL PRESSURE SWITCH
- E4 SOLENOID SWITCH
- E5 AUTOMATIC CHOKE
- E6 MAGNETO
- E7 STARTER
- E8 ENGINE GENERATOR
- E9 ENGINE GENERATOR REGULATOR
- E10 SPARK PLUGS
- E11 CAPACITOR, 0.1-UF, 100-V, DC
- H1 REMOTE START RELAY
- H2 UNDER VOLTAGE RELAY
- H3 LOCAL START RELAY
- H4 UNDER VOLTAGE RELAY
- H5 RESISTOR, 5-OHMS, 25-WATTS
- H6 STARTER RELAY
- H7 RUN-STOP RELAY
- H8 BASE DIAGRAM FOR RUN-STOP RELAY
- J1 DC AMPMETER
- J2 WATER TEMPERATURE RELAY INDICATING GAGE
- L1 LOAD TERMINAL NO. 1 WALL STUD
- L2 LOAD TERMINAL NO. 2 WALL STUD
- L3 LOAD TERMINAL NO. 3 WALL STUD
- L4 CAPACITOR, 0.1-UF, 500-V AC DC
- PT AC AMPMETER
- P2 FREQUENCY METER
- P3 TIME TOTALIZING METER
- P4 AC VOLTMETER
- P5 AC AMPMETER SWITCH
- P6 MANUAL RHEOSTAT, 25-OHMS, 150-WATTS
- P7 AUTOMATIC RHEOSTAT, 250-OHMS, 25-WATTS
- P8 POWER ON LIGHT
- P9 VOLTAGE REGULATOR SWITCH
- P10 REMOTE-LOCAL SWITCH
- P11 HEATER SWITCH
- P12 HEATER PILOT LIGHT
- P13 RECEPTACLE
- P14 FUSE, 15-AMPERE
- P15 MAIN CONTACTOR OFF SWITCH
- P16 MAIN CONTACTOR ON SWITCH
- P17 PANEL LIGHTS SWITCH
- P18 STOP SWITCH
- P19 START SWITCH
- P20 EMERGENCY OPERATION SWITCH
- P21 GROUND CONNECTION
- P22 GROUND CONNECTION
- P23 CAPACITOR, 0.1-UF, 500-V AC/DC
- P24 CAPACITOR, 0.1-UF, 500-V AC/DC
- R1 REMOTE CONTROL TERMINALS
- W1 WINTERIZATION HEATER
- X1 BATTERY-CHARGING CONNECTOR

Practical wiring diagram.



10KW ENG. GEN.
WIRING LAYOUT

WIRE CODE

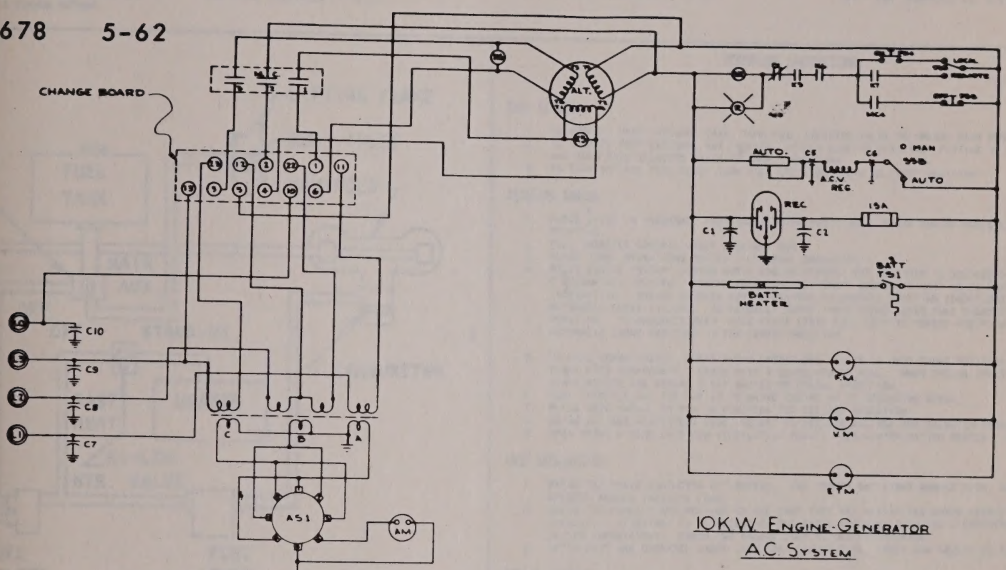
CODE IDENTIFIES TYPE OF WIRE AND TERMINATION INDICATES EACH WIRE.

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 - C = CONTROL CABINET
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 - G = GENERATOR SYSTEM
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 - L = LOAD TERMINALS
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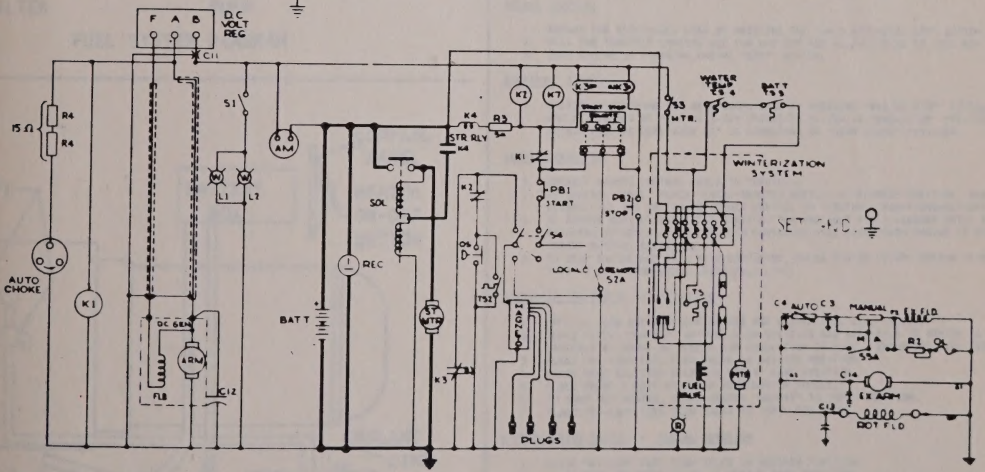
WARNING!

AVOID SHOCK HAZARD BY GROUNDING
SET WITH FRAME "GROUND" STUD.

0M678 5-62



10 KW ENGINE GENERATOR
AC SYSTEM



10 KW ENGINE GENERATOR
DC SYSTEMS

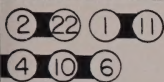
GENERATOR OPERATING CONNECTIONS MAY BE CHANGED TO RUN ON 24 VOLT POWER SUPPLY BY STARTING THE GENERATOR IN THE POSITION SHOWN IN THE FOUR DIAGRAMS BELOW. LINKS MAY BE CHANGED TO NEW POSITIONS BY LOOSENING THE LOCKING WRENCH COMPLETELY TO RELEASE THE TERMINALS. BUTS NEED NOT BE REMOVED AFTER LINKS ARE ARRANGED IN THE NEW POSITION, TIGHTEN ALL NUTS FIRMLY. WHEN LINKS ON TERMINALS 1 AND 4 ARE NOT USED THEY ARE LOCKED IN A VERTICAL POSITION (CLEAR OF ALL METAL PARTS). LINKS ARE SPACED AT TWO LEVELS TO PREVENT BENDING. CAUTION: GENERATOR MUST BE STOPPED BEFORE ADJUSTING 24 VOLT TERMINALS WITH TOOL.

X, AMPS-35

MAX. AMPS-52

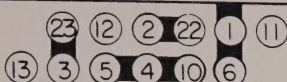
MAX. AMPS-60

MAX. AMPS-104



4 WIRE

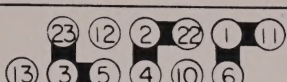
TERMINALS L0 TO L1, L2, & L3.
TERMINALS L1 TO L2, L2 TO L3,
& L3 COMMON RETURN



1 PHASE Z

3 WIRE

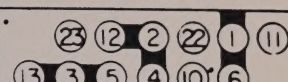
120 V USE TERMINALS L0 TO L2 OR L0 TO L3
240 V USE TERMINALS L2 TO L3.



3 PHASE Δ

3 WIRE

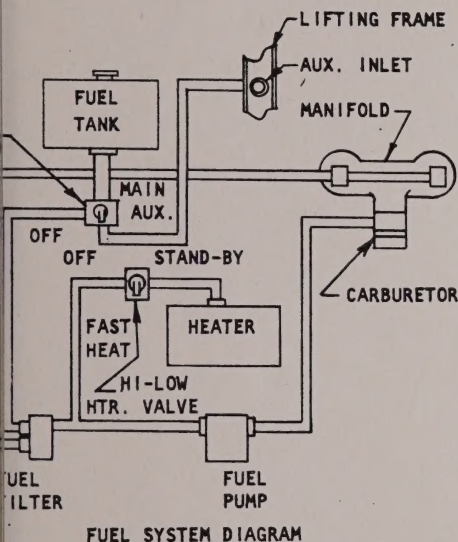
120 V USE TERMINALS L1, L2, & L3



1 PHASE Δ

2 WIRE

120 V USE TERMINALS L2, & L3



OPERATING INSTRUCTIONS

FUEL CONTROL

1. TO OPERATE FROM INTEGRAL TANK, TURN FUEL SELECTOR VALVE TO "MAIN" TANK POSITION.
2. TO OPERATE FROM EXTERNAL AUX. SOURCE, ATTACH LINE TO AUXILIARY FITTING IN LIFTING FRAME AND TURN FUEL SELECTOR VALVE TO "AUX." POSITION.
3. TO TURN OFF ALL FUEL FLOW, TURN FUEL SELECTOR VALVE TO "OFF" POSITION.

STARTING ENGINE

1. PLACE CHOKE IN "NEUTRAL" POSITION (CENTER POSITION) PRIME ENGINE FOR COLD WEATHER.
2. PULL THROTTLE CONTROL ABOUT HALF-WAY OUT.
3. PLACE 3-WAY OPERATIONS SWITCH IN "NORMAL OPERATION" POSITION.
4. PRESS ENGINE "START" BUTTON UNTIL ENGINE STARTS, BUT NOT OVER 15 SECONDS WITHOUT A 5 SECOND REST PERIOD. ALWAYS PRESS ENGINE "STOP" BUTTON IF UNIT IS TO REMAIN INOPERATIVE. MANUAL CHOKING MAY BE DESIRED IN UNUSUAL STARTING CONDITIONS OR AUTOMATIC CHOKE FAILURE. TO MANUALLY CHOKE, MOVE CHOKE LEVER FULL RIGHT TO "CLOSED" POSITION. TO MANUALLY OPEN, MOVE CHOKE LEVER FULL LEFT TO "OPEN" POSITION. AUTOMATIC CHOKE POSITION IS THE CENTER POSITION.
5. TO HAND CRANK ENGINE, PLACE 3-WAY OPERATIONS SWITCH IN HAND CRANK POSITION AND ENGAGE CRANK WITH CRANKSHAFT. CRANK WITH A QUICK UPWARD PULL. WHEN ENGINE STARTS, PUSH ENGINE START THROTTLE ALL THE WAY IN TO BRING ENGINE UP TO OPERATING SPEED.
6. PLACE AUTO-MANUAL SWITCH IN POSITION FOR DESIRED OPERATION.
7. USING VOLTAGE ADJUSTMENT KNOB, ADJUST TO DESIRED VOLTAGE FOR SELECTED OPERATION.
8. OPEN FRONT & REAR DRIP PAN VENTILATION PANELS (SEE WINTERIZATION SYSTEM - BELOW).

LOAD APPLICATION

1. PRESS THE "MAIN CONTACTOR ON" SWITCH. THE "POWER ON" LIGHT SHOULD GLOW, AND THE AMMETER SHOULD INDICATE LOAD.
2. CHECK THE CURRENT AND VOLTAGE TO SEE THAT THEY ARE WITHIN THE RATED OPERATION AND CAPACITY. IF EITHER IS IN EXCESS OF THE RATED AMOUNTS, PUSH "MAIN CONTACTOR OFF" SWITCH IMMEDIATELY. CHECK AND ADJUST LOAD BEFORE RE-APPLYING.
3. AFTER UNIT HAS OPERATED UNDER LOAD FOR A SHORT TIME, CHECK AND ADJUST VOLTAGE.

NORMAL STOPPING

1. REMOVE THE ELECTRICAL LOAD BY PRESSING THE "MAIN CONTACTOR OFF" BUTTON.
2. PULL THE THROTTLE CONTROL ALL THE WAY OUT AND ALLOW ENGINE TO IDLE FOR SEVERAL MINUTES.
3. STOP ENGINE BY PRESSING ENGINE "STOP" BUTTON.

EMERGENCY STOPPING

1. EMERGENCY STOPPING MAY BE ACCOMPLISHED BY PRESSING "ENGINE STOP" BUTTON. ALSO IT MAY BE STOPPED BY PLACING 3-WAY OPERATION SWITCH IN "EMER-STOP" POSITION; THIS METHOD MUST BE USED WHEN SET IS OPERATING ON "HAND CRANK" POSITION.

REMOTE OPERATION

1. CONNECT REMOTE CONTROL CABLE TO TERMINALS.
2. AT CONTROL PANEL, PLACE "LOCAL-REMOTE" SWITCH IN "REMOTE" POSITION, PUSH THROTTLE CONTROL ALL THE WAY IN AND CHOKE CONTROL IN "NEUTRAL" POSITION (HALF-WAY POSITION).
3. AT REMOTE STATION PRESS THE "START" BUTTON AND HOLD FOR 3 SECONDS UNTIL ENGINE STARTS. RE-PRESS IF NECESSARY. THE MAIN CONTACTOR WILL CLOSE WHEN ENGINE IS RUNNING AND "START" BUTTON RELEASED.
4. TO STOP ENGINE AND OPEN MAIN CONTACTOR, PRESS ENGINE "STOP" BUTTON AT REMOTE LOCATION. THIS IS NOT RECOMMENDED UNDER FULL LOAD.

WINTERIZATION SYSTEM - AUTOMATIC

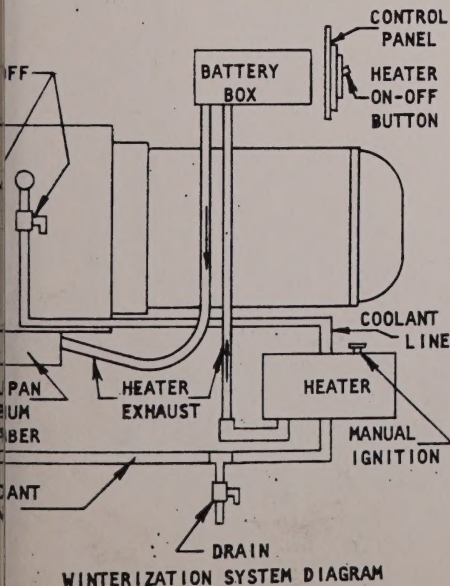
1. OPEN ALL COOLANT SHUT-OFF VALVES AND HEATER FUEL LINE VALVES.
2. PLACE HEATER "ON-OFF" SWITCH IN ON POSITION AND ASCERTAIN IF HEATER IS FUNCTIONING PROPERLY BY SOUND OF BLOWER AND COMBUSTION OF FUEL. CHECK FOR FUEL SEEPAGE.
3. PLACE "HI-LOW" FUEL FLOW VALVE IN DESIRED POSITION.
4. PLACE FUEL SELECTOR VALVE IN "MAIN" TANK POSITION.
5. CLOSE FRONT & REAR DRIP PAN VENTILATION PANELS.
6. TO SHUT OFF HEATER, PLACE HEATER "ON-OFF" TO "OFF" POSITION.
7. PLACE "HI-LOW" FUEL FLOW VALVE TO "OFF" POSITION.

WINTERIZATION SYSTEM - MANUAL IGNITION

1. PLACE "HI-LOW" FUEL FLOW VALVE IN DESIRED POSITION.
2. PLACE FUEL SELECTOR VALVE IN "MAIN" TANK POSITION.
3. TURN HEATER "ON-OFF" SWITCH TO "ON" POSITION AND LET HEATER RUN ABOUT ONE MINUTE, THEN TURN HEATER OFF.
4. REMOVE CAP AND WICK FROM MANUAL IGNITION TEE AND SOAK WICK WITH FUEL. LIGHT AND REPLACE IN TEE.
5. PLACE HEATER "ON-OFF" SWITCH IN "ON" POSITION WHILE WICK IS BURNING. TIGHTEN CAP WITH FINGER PRESSURE.
6. CLOSE FRONT & REAR DRIP PAN VENTILATION PANELS.

LUBRICATION POINTS

1. THE GENERATOR GROUP DOES NOT REQUIRE LUBRICATION AS SEALED LUBRICATED BEARINGS ARE USED.
2. CONTROL CABLES AND LATCHES MAY BE LUBRICATED WITH A FEW DROPS OF LIGHT MACHINE OIL.
3. APPLY SEVERAL DROPS OF ENGINE OIL TO THE CARBURETOR LINKAGE AND GOVERNOR LINKAGE POINTS.
4. THE FOLLOWING LUBRICANTS ARE RECOMMENDED FOR USE UNDER THE LISTED TEMPERATURE RANGES:
 - a. -45°F. TO 0°F. MIL-O-10295 OIL-ENGINE OIL ZEO.
 - b. 0°F. TO 32°F. MIL-O-2104 OIL-ENGINE, HEAVY DUTY GRADE SAE 10.
 - c. ABOVE PLUS 32°F. MIL-O-2104 OIL-ENGINE HEAVY DUTY GRADE 30.



ENGINE

(Prime Mover)

Teledyne Continental Motors Corp.

Industrial Products Div.

700 Terrace St.

Muskegon, Mich. 49443

Phone (616) 724-3431 or 724-3778

Mr. Don Hindes or Walter Kozick

Model - FS162, Spec. 6055

Engine No. 15542

31.4 HP at 2200 RPM

Four cylinder, L head

Compression ratio - 6.3 to 1.

Liquid cooled, Gasoline fueled

Manufactured - Dec., 1962

Operation and Maintenance Instructions

L-HEAD ENGINES

FOUR CYLINDER

N56 — N62

Y69 — Y91 — Y112

F124 — F135 — F140 — F162 — F163

SIX CYLINDER

F186 — F209 — F226 — F227 — F244 — F245

M271 — M290 — M330 — M363

B371 — B427



TELEDYNE CONTINENTAL MOTORS

TELEDYNE CONTINENTAL MOTORS
Printed in U. S. A.

Form No. X-27053A — Revised 1-72

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FOREWORD

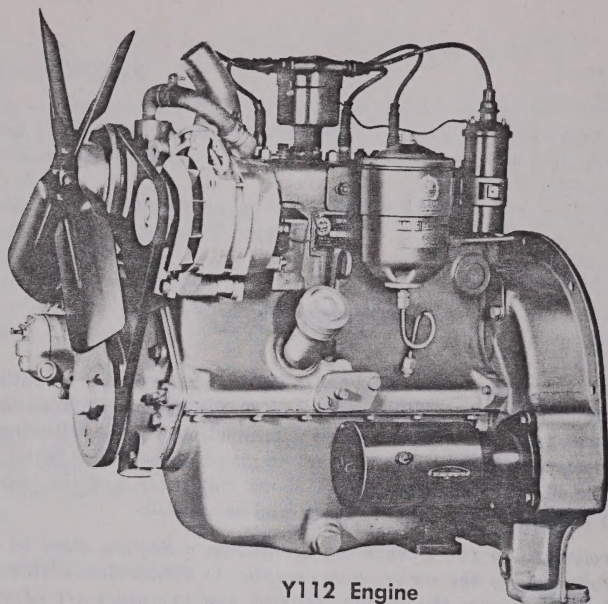
Good operation and a planned maintenance program as outlined in this manual are of vital importance in obtaining maximum engine performance, and long engine life. The instructions on the following pages have been written with this in mind, to give the operator a better understanding of the various problems which may arise, and the manner in which these problems can best be solved or avoided.

Procedure in the Preventive Maintenance Section must be set up and followed by the owner and operator to obtain dependable service and long life from the engine. Owners and operators are expected to perform these maintenance procedures as outlined under the daily schedule as well as 50-hr., 250-hr., and 500-hr. periods WHILE IN THE WARRANTY PERIOD AS WELL AS DURING THE LIFE OF THE ENGINE.

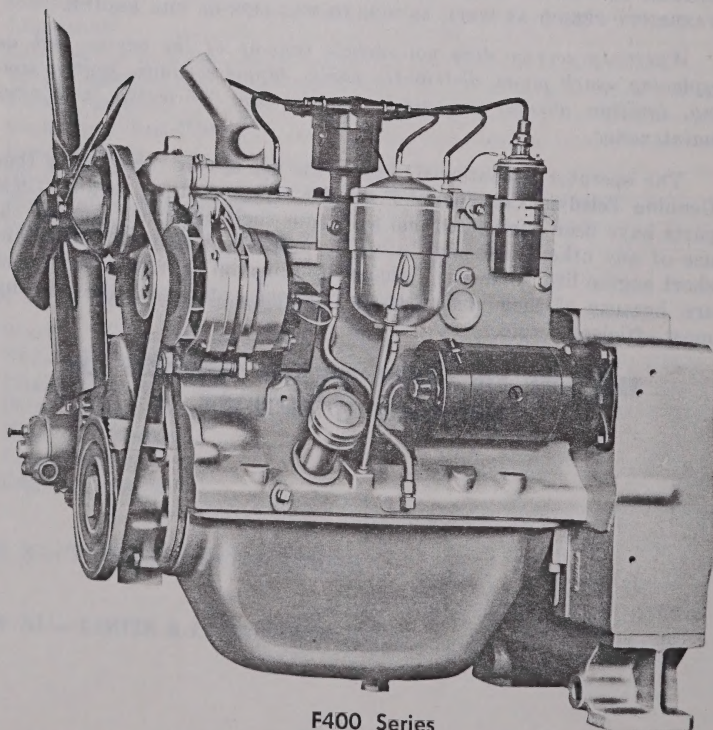
Warranty service does not include tune-up of the engine such as replacing spark plugs, distributor points, tappet settings, ignition timing, ignition wiring, air cleaner service and lubrication and filter maintenance.

The operator is cautioned against the use of any parts, other than **Genuine Teledyne Continental Parts** for replacement or repair. These parts have been engineered and tested for their particular job, and the use of any other parts may result in unsatisfactory performance and short engine life. Likewise, Teledyne-Continental distributors and dealers, because of their close factory relations, can render the best and most efficient service.

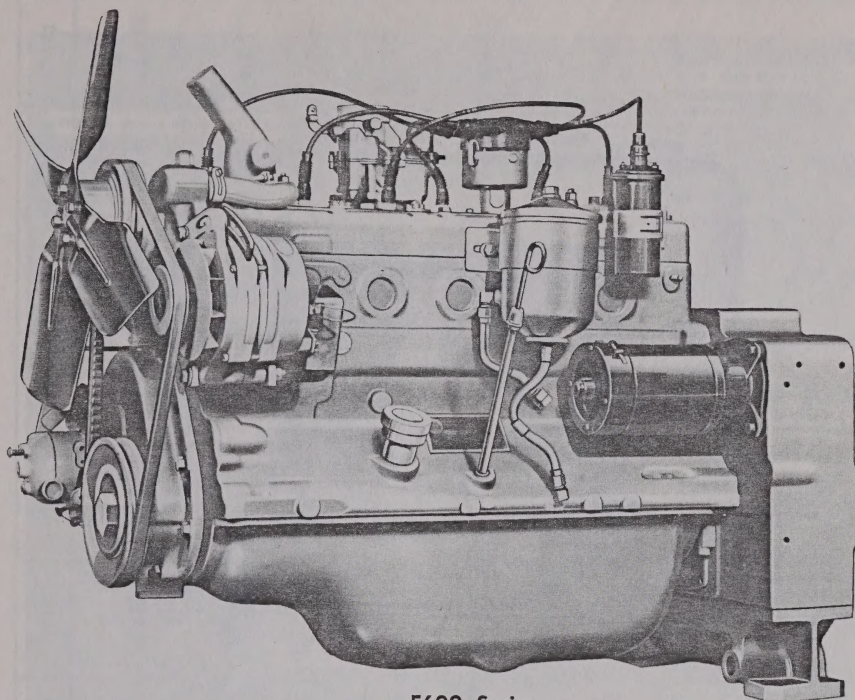
**THE LIFE OF YOUR ENGINE DEPENDS ON
THE CARE IT RECEIVES.**



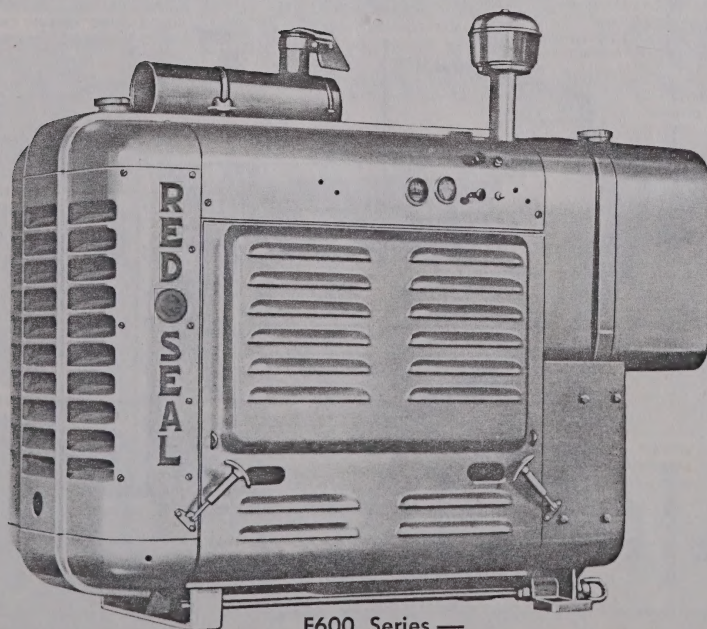
Y112 Engine



F400 Series



F600 Series



F600 Series —

Closed Power Unit

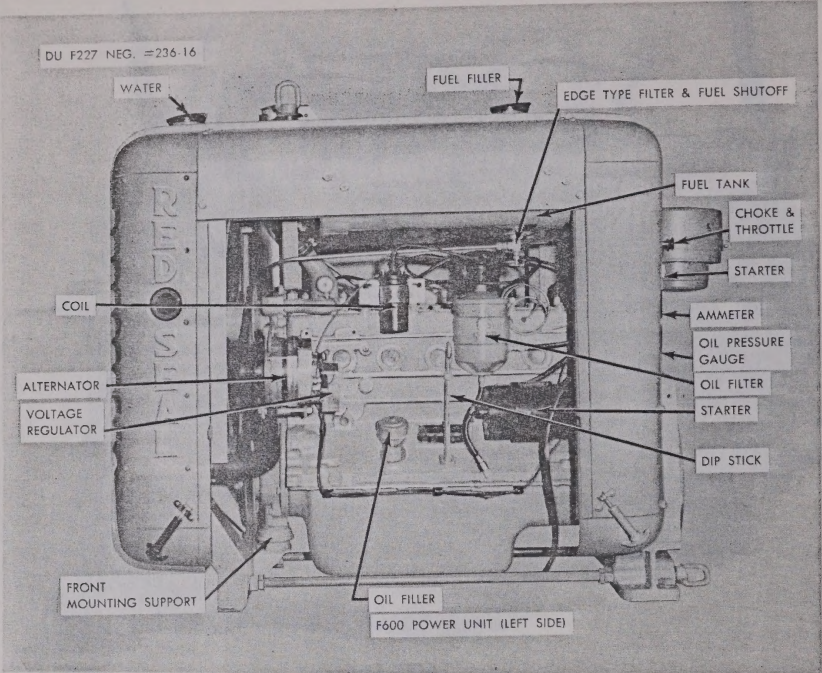


Figure 7 — F600 Power Unit (left side)

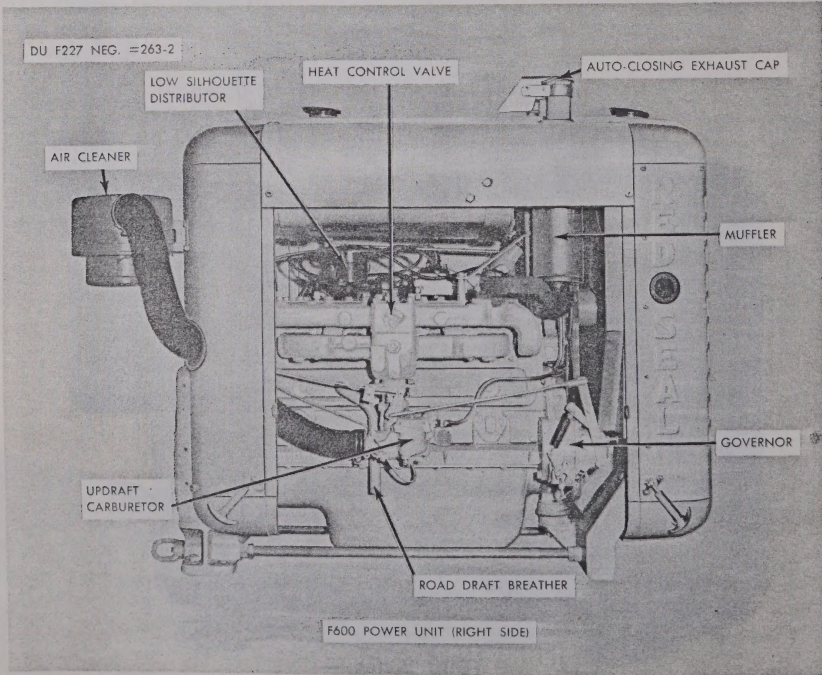


Figure 8 — F600 Power Unit (right side)

FOUR CYLINDER INDUSTRIAL L-HEAD ENGINES*

MODEL	N-56	N-62	Y-69	Y-91	Y-112	F-124	F-135	F-140	F-162	F-163
No. of cylinders	4	4	4	4	4	4	4	4	4	4
Bore and Stroke	$2\frac{1}{4} \times 3\frac{1}{2}$	$2\frac{3}{8} \times 3\frac{1}{2}$	$2\frac{1}{2} \times 3\frac{1}{2}$	$2\frac{7}{8} \times 3\frac{1}{2}$	$3\frac{3}{16} \times 3\frac{1}{2}$	$3 \times 4\frac{3}{8}$	$3\frac{1}{8} \times 4\frac{3}{8}$	$3\frac{3}{16} \times 4\frac{3}{8}$	$3\frac{3}{16} \times 4\frac{3}{8}$	$3\frac{3}{16} \times 4\frac{3}{8}$
Displacement Cu. In.	56	62	69	91	112	124	135	140	162	162
Compression Ratio	6.12	6.46	6.66	6.46	6.07	6.28	7.2:1	6.00	6.01	7.4:1
Max. Oil Pressure**	20-30	20-30	30-40	30-40	30-40	20-30	30-40***	20-30	20-30	30-40***
Min. Oil Pressure (Idling)	7	7	7	7	7	7	7	7	7	7
Firing Order	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2
Main Brg. Frt.	$2 \times 1\frac{1}{32}$	$2 \times 1\frac{1}{32}$	$1\frac{3}{4} \times 1\frac{1}{32}$	$1\frac{3}{4} \times 1\frac{1}{32}$	$1\frac{3}{4} \times 1\frac{1}{32}$	$2\frac{1}{4} \times 1\frac{1}{8}$	$2\frac{3}{8} \times 1\frac{1}{16}$	$2\frac{1}{4} \times 1\frac{1}{8}$	$2\frac{1}{4} \times 1\frac{1}{8}$	$2\frac{3}{8} \times 1\frac{1}{16}$
Main Brg. Center			$1\frac{3}{4} \times 1\frac{1}{16}$	$1\frac{3}{4} \times 1\frac{1}{16}$	$1\frac{3}{4} \times 1\frac{1}{16}$	$2\frac{1}{4} \times 1\frac{1}{8}$	$2\frac{3}{8} \times 1\frac{1}{16}$	$2\frac{1}{4} \times 1\frac{1}{8}$	$2\frac{1}{4} \times 1\frac{1}{8}$	$2\frac{3}{8} \times 1\frac{1}{16}$
Main Brg. Rear	$2 \times 1\frac{1}{32}$	$2 \times 1\frac{1}{32}$	$1\frac{3}{4} \times 1\frac{1}{16}$	$1\frac{3}{4} \times 1\frac{1}{16}$	$1\frac{3}{4} \times 1\frac{1}{16}$	$2\frac{1}{4} \times 1\frac{1}{8}$	$2\frac{3}{8} \times 1\frac{1}{16}$	$2\frac{1}{4} \times 1\frac{1}{8}$	$2\frac{1}{4} \times 1\frac{1}{8}$	$2\frac{3}{8} \times 1\frac{1}{16}$
Conn. Rod Brg.										
Dia. and Length	$1\frac{1}{2} \times 3\frac{3}{4}$	$1\frac{1}{2} \times 3\frac{3}{4}$	$1\frac{1}{2} \times 1$	$1\frac{1}{2} \times 1$	$1\frac{1}{2} \times 1$	$1\frac{1}{2} \times 1\frac{1}{8}$	$2\frac{1}{16} \times 1\frac{1}{8}$	$1\frac{1}{2} \times 1\frac{1}{8}$	$1\frac{1}{2} \times 1\frac{1}{8}$	$2\frac{1}{16} \times 1\frac{1}{8}$
Oil Capacity Crankcase	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	4	4	4	4	4
Filter	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Total	4	4	4	4	4	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$
Valve Clearance										
Intake	.015	.012	.012	.012	.012	.014	.012	.014	.014	.012
Exhaust	.015	.012	.012	.020	.020	.016◇	.020	.016◇	.016◇	.020
Water Capacity (Given in quarts — add approximately 1 quart for hoses)										
Engine	2	2	$3\frac{3}{4}$	$3\frac{3}{4}$	$3\frac{3}{4}$	5	5	5	5	5
Engine and Radiator	11	11	14	15	15	14	14	14	15	15
Weight (Bare Engine)	180	210	290	290	290	415	415	415	415	415

*Dimensions and data shown are for Standard Industrial Engines.

**Note: Other oil pressures are available, based on customer specifications.

***Oil pressure with oil pressure relief valve spring number 10EL00230 on engines built after December 1971. Previous to that, oil pressure relief valve spring F40L00223 was used with 20-30± pressure.

◇ Static or cold setting .017

SIX CYLINDER L-HEAD ENGINES*

M O D E L	F-186	F-209	F-226	F-227	F-244	F-245	M-271	M-290	M-330	M-363	B-371	B-427
No. of Cylinders	6	6	6	6	6	6	6	6	6	6	6	6
Bore & Stroke	3 x 4 $\frac{3}{8}$	3 $\frac{1}{8}$ x 4 $\frac{3}{8}$	3 $\frac{1}{8}$ x 4 $\frac{3}{8}$	3 $\frac{5}{8}$ x 4 $\frac{3}{8}$	3 $\frac{1}{8}$ x 4 $\frac{3}{8}$	3 $\frac{1}{8}$ x 4 $\frac{3}{8}$	3 $\frac{5}{8}$ x 4 $\frac{3}{8}$	3 $\frac{3}{4}$ x 4 $\frac{3}{8}$	4 x 4 $\frac{3}{8}$	4 x 4 $\frac{13}{16}$	4 $\frac{1}{8}$ x 4 $\frac{5}{8}$	4 $\frac{5}{16}$ x 4 $\frac{7}{8}$
Displacement Cu. In.	186	209	226	226	244	244	271	290	330	363	371	427
Compression Ratio	6.43	6.09	6.02	7.28	6.9	7.2	6.12	5.96	6.75	6.70	5.96	5.76
Max. Oil Pressure**	20-30	20-30	20-30	30-40***	20-30	30-40***	30-40	30-40	30-40	30-40	40-50	40-50
Min. Oil Pressure	7	7	7	7	7	7	7	7	7	7	7	7
Firing Order	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4
Main Brg. — Front	2 $\frac{1}{4}$ x 1 $\frac{1}{8}$	2 $\frac{1}{4}$ x 1 $\frac{1}{8}$	2 $\frac{3}{8}$ x 1 $\frac{1}{8}$	2 $\frac{3}{8}$ x 1 $\frac{1}{8}$	2 $\frac{3}{8}$ x 1 $\frac{1}{8}$	2 $\frac{3}{8}$ x 1 $\frac{1}{8}$	2 $\frac{5}{8}$ x 1 $\frac{3}{16}$	2 $\frac{5}{8}$ x 1 $\frac{3}{16}$	2 $\frac{5}{8}$ x 1 $\frac{3}{16}$	2 $\frac{5}{8}$ x 1 $\frac{3}{16}$	2 $\frac{5}{8}$ x 1 $\frac{3}{16}$	2 $\frac{5}{8}$ x 1 $\frac{15}{32}$
Main Brg. — Int.	(2) 2 $\frac{1}{4}$ x 1 $\frac{1}{8}$	(2) 2 $\frac{1}{4}$ x 1 $\frac{1}{8}$	(2) 2 $\frac{3}{8}$ x 1 $\frac{1}{8}$	(2) 2 $\frac{3}{8}$ x 1 $\frac{1}{8}$	(2) 2 $\frac{3}{8}$ x 1 $\frac{1}{8}$	(2) 2 $\frac{3}{8}$ x 1 $\frac{1}{8}$	(4) 2 $\frac{5}{8}$ x 1 $\frac{1}{8}$	(4) 2 $\frac{5}{8}$ x 1 $\frac{1}{8}$	(4) 2 $\frac{5}{8}$ x 1 $\frac{1}{8}$	(4) 2 $\frac{5}{8}$ x 1 $\frac{1}{8}$	(4) 2 $\frac{5}{8}$ x 1 $\frac{1}{8}$	(4) 2 $\frac{5}{8}$ x 1 $\frac{1}{8}$
Main Brg. — Center							2 $\frac{5}{8}$ x 2 $\frac{1}{8}$	2 $\frac{5}{8}$ x 2 $\frac{1}{8}$	2 $\frac{5}{8}$ x 2 $\frac{1}{8}$	2 $\frac{5}{8}$ x 2 $\frac{1}{8}$	2 $\frac{5}{8}$ x 2 $\frac{1}{8}$	2 $\frac{5}{8}$ x 2 $\frac{1}{8}$
Main Brg. — Rear	2 $\frac{1}{4}$ x 1 $\frac{1}{8}$	2 $\frac{1}{4}$ x 1 $\frac{1}{8}$	2 $\frac{3}{8}$ x 1 $\frac{1}{8}$	2 $\frac{3}{8}$ x 1 $\frac{1}{8}$	2 $\frac{3}{8}$ x 1 $\frac{1}{8}$	2 $\frac{3}{8}$ x 1 $\frac{1}{8}$	2 $\frac{5}{8}$ x 1 $\frac{1}{8}$	2 $\frac{5}{8}$ x 1 $\frac{1}{8}$	2 $\frac{5}{8}$ x 1 $\frac{1}{8}$	2 $\frac{5}{8}$ x 1 $\frac{1}{8}$	2 $\frac{5}{8}$ x 1 $\frac{1}{8}$	2 $\frac{5}{8}$ x 1 $\frac{1}{8}$
Conn. Rod Brg.	1 $\frac{1}{8}$ x 1 $\frac{1}{8}$	1 $\frac{1}{8}$ x 1 $\frac{1}{8}$	2 $\frac{1}{8}$ x 1 $\frac{1}{8}$	2 $\frac{1}{8}$ x 1 $\frac{1}{8}$	2 $\frac{1}{8}$ x 1 $\frac{1}{8}$	2 $\frac{1}{8}$ x 1 $\frac{1}{8}$	2 $\frac{1}{4}$ x 1 $\frac{1}{8}$	2 $\frac{1}{4}$ x 1 $\frac{1}{8}$	2 $\frac{1}{4}$ x 1 $\frac{1}{8}$	2 $\frac{1}{4}$ x 1 $\frac{1}{8}$	2 $\frac{1}{4}$ x 1 $\frac{1}{8}$	2 $\frac{1}{4}$ x 1 $\frac{1}{8}$
Oil Capacity												
Crankcase	5	5	5	5	5	5	7	7	7	7	8	8
Filler	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1	1	1	1	1	1
Total	5 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	8	8	8	8	9	9
Valve Clearance												
Intake	.014	.014	.014	.012	.014	.012	.017	.017	.017	.017	.017	.017
Exhaust	.016◇	.016◇	.016◇	.020	.016◇	.020	.020	.020	.020	.020	.022	.022
(Given in quarts — add approximately 1 qt. for hoses)												
Water Capacity												
Engine	6 $\frac{1}{2}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	13 $\frac{1}{2}$	13 $\frac{1}{2}$	13 $\frac{1}{2}$	13 $\frac{1}{2}$	16	16
Radiator	10 $\frac{1}{2}$	10 $\frac{1}{2}$	10 $\frac{1}{2}$	10 $\frac{1}{2}$	10 $\frac{1}{2}$	10 $\frac{1}{2}$	17 $\frac{1}{2}$	17 $\frac{1}{2}$	17 $\frac{1}{2}$	19 $\frac{1}{2}$	20	20
Total	17	17	17	17	17	17	31	31	33	33	36	36
Weight — Bare Engine	550	550	555	555	565	565	800	800	800	800	945	950

*Dimensions and data shown are for Standard Industrial Engines.

**Note: Other oil pressures are available, based on customer specifications.

***Oil pressure with oil pressure relief valve spring number 10E00230 on engines built after December 1971. Previous

INFORMATION FOR ORDERING PARTS

When ordering parts, refer to the engine name plate attached to side of the cylinder block, which lists the model and serial number. In most cases a specification number is listed. This data is of vital importance in obtaining the correct parts: always include this information on your parts order.

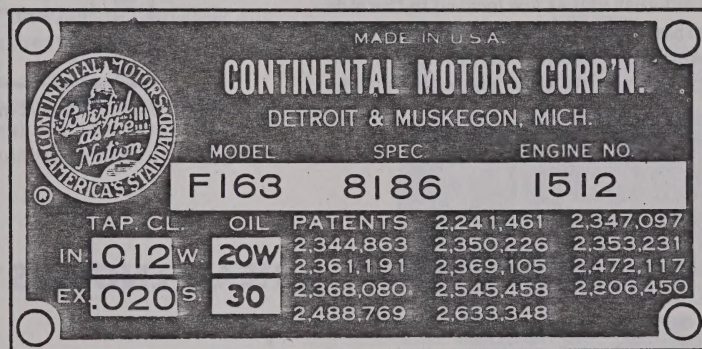


Figure 9 — Nameplate

SECTION 1 GENERAL INFORMATION

L-Head engines have inherent design advantages which result in a more simple engine of lower height, weight and cost. All valves, cams, valve lifters and all other moving parts are a part of the cylinder block assembly.

The cross-section of an L-Head engine resembles the letter "L" written upside down and engines with this type of combustion chamber are also called side-valve engines.

Intake and exhaust valves are located in the side pocket and both are directly operated through tappets from a single camshaft. This provides a simple and heavy duty valve gear, since there is no deflection.

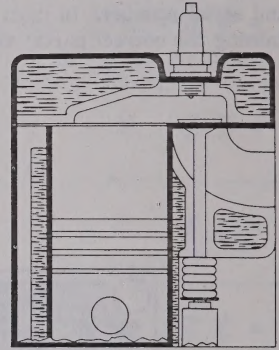


Figure 10 — L-head design

CONTINENTAL L-HEAD ENGINES

Continental has eight basic four-cylinder and ten six-cylinder L-Head type engines, ranging in size from 56 to 427 cubic inch displacement.

The combustion chamber design has been tailored for the required turbulence, charge flow and burning characteristics to provide dependable and economical heavy duty service.

Some of the principal design features are:

1. **Individual Porting** — of the intake manifold whereby each cylinder is fed with the fuel-air mixture individually and not influenced by other cylinders of the engine.

This is accomplished by casting the cylinder block with individual intake valve passages for each cylinder and connecting these passages to an intake manifold which also has individualized passages for each cylinder.

This equal distribution results in maximum power, smooth operation, easy starting and longer engine life.

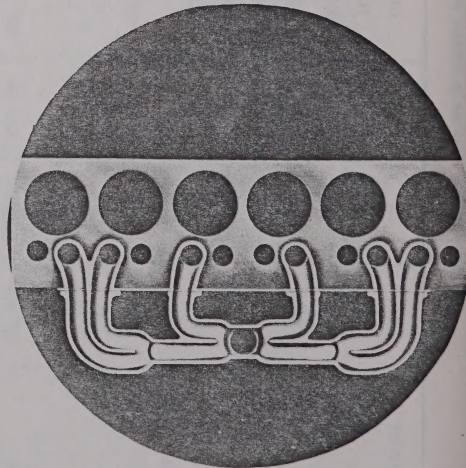


Figure 11 — Individual Porting

Directional Cooling — is accomplished by regulating the course of the cool water from the water pump so it first comes in contact with exhaust valve seats and then to other points as indicated by their relative temperatures.

This feature promotes uniform cooling throughout the system, prevents hot-spots and prolongs valve life.

This coupled with the by-pass and thermostat included in the engine assembly, insures rapid warm-up and even temperature distribution.

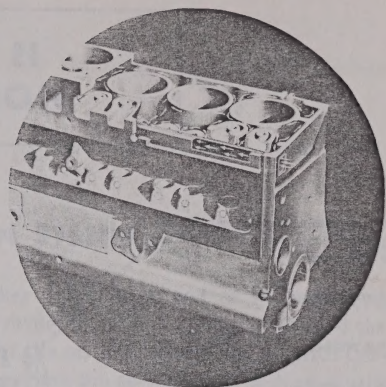


Figure 12 — Directional Cooling in Block

Full Length Water Jackets — completely surround all cylinder bores the full length of the piston travel.

This insures uniform cooling with minimum bore distortion — which results in lower oil consumption; less blow-by and minimum tendency to sludge.

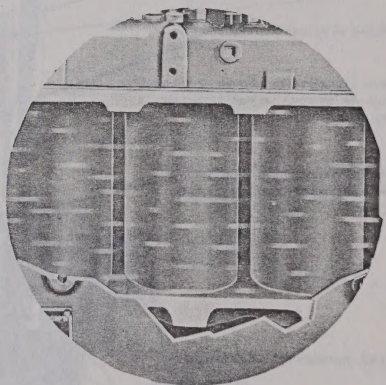


Figure 13 — Full Length Water Jackets

Removable Tappets — The large, barrel shaped, pressure lubricated tappets are so designed that by removing the adjusting screw — the main body can be lifted out and replaced from above through the valve chamber. This eliminates the costly service operation of dropping the oil pan and pulling the camshaft. Locking of the adjustment is both simple and effective.

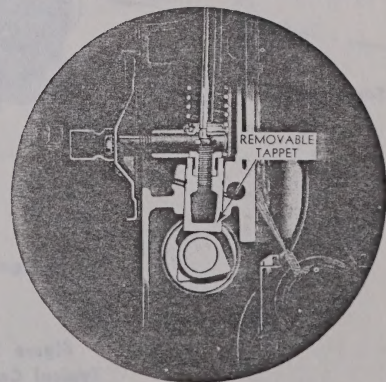


Figure 14 — Removable Tappets

Choice of Fuels — Gasoline - LPG - Natural Gas Fuel Oil — Continental L-Head engines have been tailored for heavy-duty operation using gasoline - LPG - natural gas - fuel oil fuels.

More than conventional number of studs to prevent gasket failures, distortion of cylinder bores and valve seats

Cylinder head gasket

Chrome top rings

Full length water jackets

Piston

Heavily ribbed alloy cast iron block

Full pressure lubrication to all main, connecting rod and cam bearings, as well as tappets and timing gears

Spurt hole for lubrication of thrust side of cylinder walls, piston pins, and cooling of piston head

Oil filler

Drop forged, counterweighted crankshaft

Alloy steel heat treated connecting rod and main bearing bolts and nuts

Dipstick

Float-o-Screen

Lubrication to piston pins

Valve seat inserts

Exhaust valve

Valve guides

Valve springs

Positive Roto exhaust valve

Tappets removable without pulling camshaft

Camshaft

Main and connecting rod bearing

Crankcase ventilation

Submerged gear type oil pump driven off camshaft

Figure 15 — Cross Section of a Typical Continental "L" Head Engine

SECTION II LUBRICATION

ENGINE LUBRICATION SYSTEM

Continental L-Head engines have full pressure lubrication to all main, connecting rod and camshaft bearings as well as tappets and timing gears.

To insure piston pin lubrication and prevent piston scuffing during the warm-up period in cold

weather — the large end of the connecting rods have drilled spurt holes pointing toward the thrust side of the pistons. These line up with the oil hole in the crank pin so that once each revolution, oil is sprayed on the cylinder wall for lubrication.*

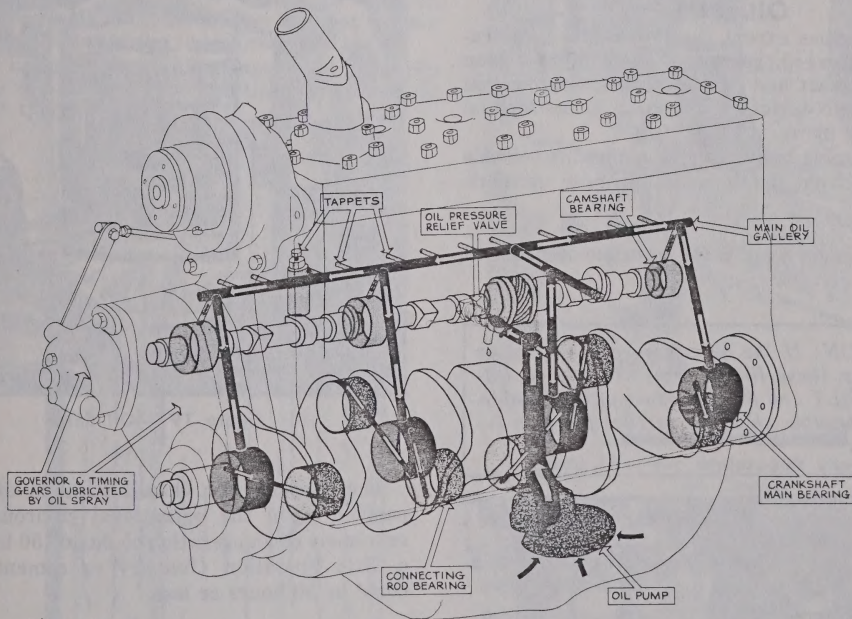


Figure 16 — Oiling Diagram

* NOTE: On some recent models, the connecting rod spurt holes have been plugged or eliminated. This does not in any way effect the lubrication of the engine.

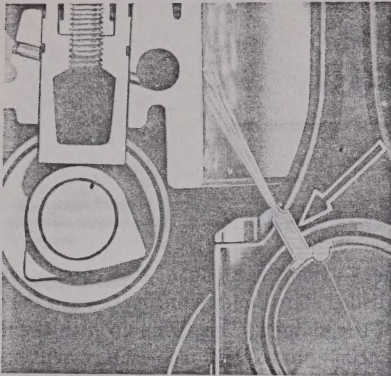


Figure 17 — Connecting Rod Spurt Hole
(see note on page 11)

OIL PUMP

On all engines except the N-series, a large capacity, submerged, gear type oil pump is driven off the camshaft and protected by a large screen inlet; on the N-series the oil pump is mounted on the rear end plate.

An adjustable by-pass valve maintains suitable oil pressure from idle to maximum speed automatically.

Refer to pages 5 and 6 for complete oil pressure figures.

CAUTION: If the oil pressure is erratic or falls below these limits, stop the engine **IMMEDIATELY** and find the cause of the trouble. Refer to trouble shooting section for this information.

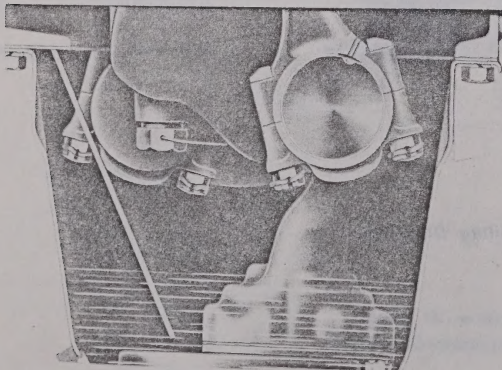


Figure 18 — Oil Pump

*Other pressures are available, based on customer specifications.

A by-pass type oil filter is normally provided to remove dirt and foreign elements from the oil, a percentage of which is passed through the filter during the operating period. The removal of grime, sludge and foreign particles causes filter elements to clog and become ineffective unless they are normally replaced every 150 hours.

OIL CHANGE FREQUENCY

Engine oil does not "wear out". However, the lubricating oil in internal-combustion engines becomes contaminated from the by-products of combustion: dirt, water, unburned fuel entering the crankcase, and the detergents holding the carbon particles in suspension in the crankcase.

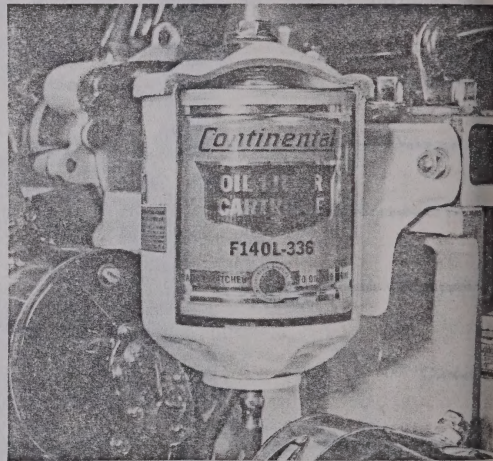


Figure 19 — Oil Filter

The schedule for changing oil is directly dependent upon the operational environment: an extremely clean operation could go 150 hours while a dirty operation (foundry or cement factory) could be 50 hours or less.

RUNNING-IN NEW OR RECONDITIONED ENGINES

No special oil is required — use the oil recommended for the ambient temperature. (See chart on page 14.)

DO NOT FLUSH CRANKCASE WITH KEROSENE

Some operators unwisely put kerosene in the crankcase after draining the engine oil, then turn the engine over with the starter — in the belief they are doing a better job of crankcase cleaning.

In doing this, kerosene is circulated through the oil pump, the main oil header and the branches leading into the engine bearings — thereby washing away the protective oil film. In addition, some of the kerosene will be trapped and remain to thin out the new oil, reducing its lubricating qualities.

Do not put kerosene into the crankcase. The best method is to drain the oil when the engine is thoroughly heated — which will carry off most of the sediment.

AIR CLEANER

All engines, when operating, consume several thousand cubic feet of air per hour. Since dusty air is full of abrasive matter, the engine will soon wear excessively if the air cleaner does not remove the dust before entering the cylinders.

Two basic types of air cleaners are normally used — the oil bath type and the dry replaceable element type.

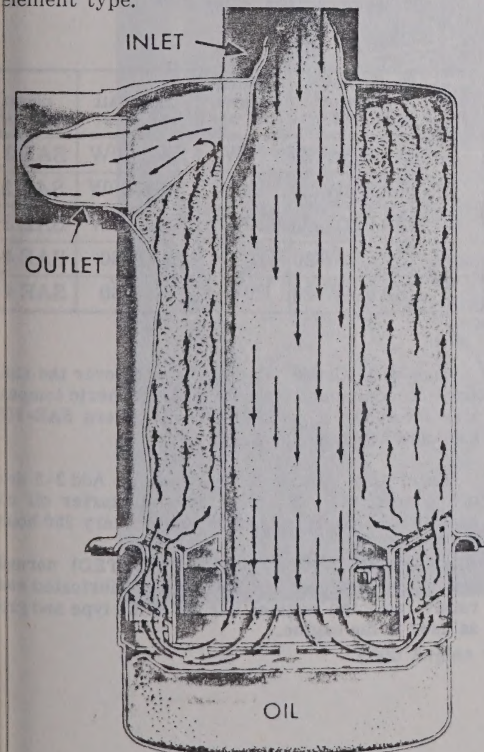


Figure 20 — Sectional View of Oil Bath Air Cleaner

Operating conditions determine the air cleaner service periods. In extremely dusty operations, this may be once or twice daily. In dust protected

areas, the air cleaner should be serviced when changing oil.

As the dirt is strained from the air flowing through the cleaner, it thickens the oil in the cup and raises the level. If the level is too high, agitation of the oil on the screen is affected and gritty oil is carried over into the air stream, through the carburetor and into the engine cylinders. This would actually introduce a grinding compound with resulting very rapid wear.

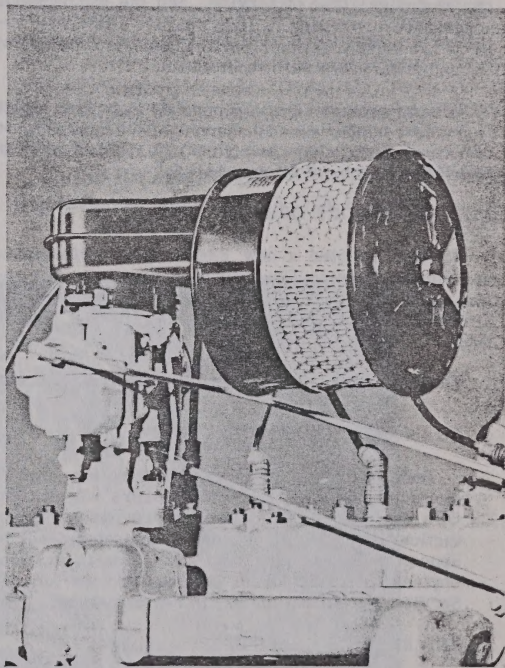


Figure 21 — Dry Replaceable Element Type Air Cleaner

By actual measurement, the amount of dust shown below, when admitted in the volume shown every hour, will completely ruin an engine in an eight hour day.

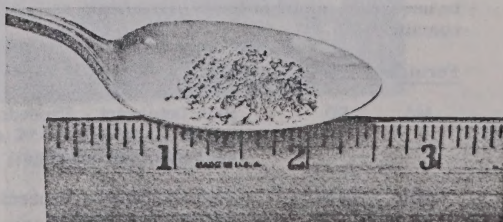


Figure 22

Proper servicing means Cleaning Thoroughly and Refilling with New Engine Oil, and Maintaining Air-Tight Connections between the air cleaner and intake manifold so that All Air Entering The Engine Is Filtered.

LUBRICATION RECOMMENDATIONS

Motor oils used for internal-combustion engine lubrication perform many useful functions including: Dissipating heat, sealing piston rings, preventing metal-to-metal contact wear and reducing power loss through friction.

The lubricating oil recommendation is based upon engine design, type of service, and the atmospheric temperature prevailing. High quality oils are required to assure maximum performance, long engine life, and minimum cost of operation.

L-Head gasoline engines operate in a wide range of service conditions and seasonal temperatures, so our recommendations are given for various types of service and ambient temperatures.

NEW API SERVICE DESIGNATIONS

API has adopted a new Engine Oil Performance and Engine Service Classification System. We recommend using the two oils described below for all L-Head engine applications (Gasoline - LPG - Natural Gas).

The new API designations are explained as follows:

SD - SERVICE CLASS D

Service typical of industrial gasoline engines operating under engine manufacturers' warranties. Oils designed for this service provide more protection from high and low temperature engine deposits, wear, rust and corrosion in gasoline engines than oils which are satisfactory for API Service Classification SC* is recommended.

SE - SERVICE CLASS E

Service typical of industrial gasoline engines operating under engine manufacturers' warranties. Oils designed for this service provide more protection against oil oxidation, high temperature engine deposits, rust and corrosion in gasoline engines than oils which are satisfactory for API Engine Service Classifications SD or SC* and may be used when either of these classifications is recommended.

Former	New	Oil Type
MS	SD	High Detergent - Exceeds engine manufacturer warranty requirements.
MS	SE	High Detergent - Exceeds engine manufacturer warranty requirements.

S.A.E. OIL BODY GRADES

The oil body grades available from the lightest (SAE 5W) to the heaviest (SAE 40) are:

5W	10W	20W	20	30	40
← 5W - 20 →					
	← 10W - 30 →				

Multi-Grade Oils such as SAE 5W-20 and SAE 10W-30 have the starting grade characteristics of the lighter oil and after it warms up it has the running characteristic of the heavier grade.

The following SAE grades are general recommendations for Continental L-Head engines during changing seasonal atmospheric temperatures:

ENGINE SERIES	SEVERE WINTER BELOW 0°F.	NORMAL WINTER 0° - 32°F.	SPRING-FALL 32° - 75°F.	SUMMER ABOVE 75°F.
N	SAE 5W-20	10W	SAE 20W	SAE 30
Y	SAE 5W-20	10W	SAE 20W	SAE 30
F	SAE 5W-20	10W	SAE 20W	SAE 30
M	SAE 5W-20	20W	SAE 30	SAE 40
B	SAE 5W-20	20W	SAE 30	SAE 40

The Multi-Grade oil used should cover the single grade recommendation for the atmospheric temperature involved, e.g. SAE 10W-30 covers SAE-10W SAE-20W, SAE 20 and SAE 30.

Generators, Starters, Distributors - Add 3-5 drop of engine oil to the generator and starter oil cup every 50 hours and to the distributor every 250 hours

AIR COMPRESSORS (ENGINE MOUNTED) normally are engine lubricated. However, if lubricated separately from the engine, use the same type and grade as used in the engine.

* SC mild detergent oil, formerly MM.

Clutches — Use a high temperature bearing grease. Do not over-lubricate.

Conventional Transmissions — For the greatest efficiency over the life of the transmission, use a high quality straight mineral oil. The oil should be changed seasonally.

Use the following proper grades:

	SUMMER	WINTER
Clark	SAE 90	SAE 90
Fuller	SAE 140	SAE 90
Twin Disc	SAE 40	SAE 40
Warner	SAE 140	SAE 90

Torque Converters and Hydraulic or Automatic Transmissions — These units employ a fluid medium to transmit power which must be very stable

to resist formation of harmful deposits or change in body in use. The correct fluid must be selected to obtain maximum efficiency of the transmission. All fluids should be changed seasonally.

Type "A" Automatic Transmission fluid is most widely used. There are many widely distributed brands of this type.

For some models of Twin Disc Clutch Company's torque converters, a Special Fluid having a viscosity of 35 Saybolt seconds @ 100° F. is required — other models use SAE 10W engine oil. The Special low viscosity fluid may be obtained from Twin Disc Clutch Company Dealers. To satisfy the SAE 10W requirement, we recommend the use of MS type oils.

Allison Division torque converters and Torqmatic transmissions require a type C fluid.

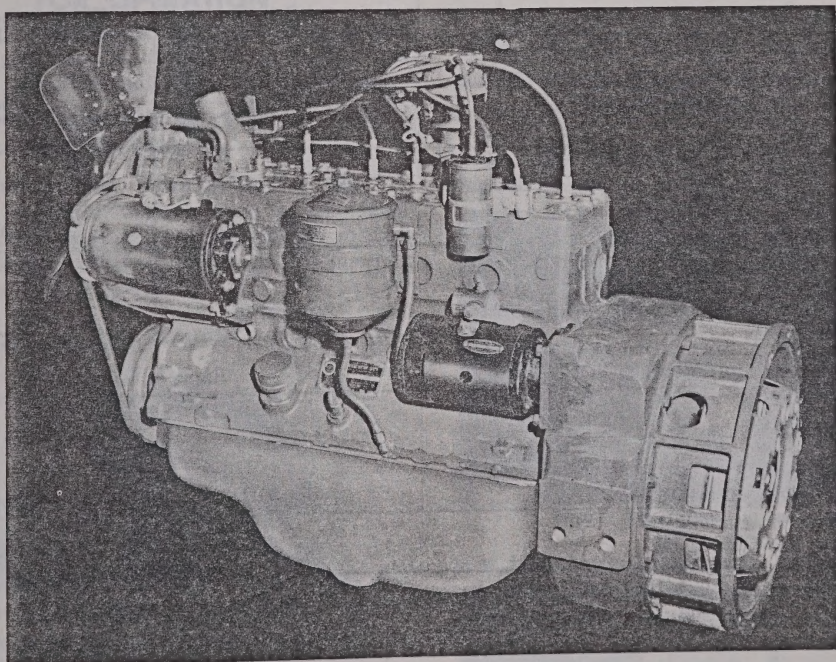


Figure 22A
F600 Engine with a Hydraulic Coupling

TRANSMISSION AND CONVERTER LUBRICATION RECOMMENDATIONS

The following grades are generally recommended for hydraulic torque converters and transmissions for Summer and Winter operation:

MANUFACTURER	SUMMER	WINTER
Continental Motors Corp. Co-Matic Drive Fluid Coupling HC15	Type A Type A	Type A Type A
Clark Equipment Co. Torcon (converter only) Torcon Converter and Transmission	SAE 10W Type A	Type A (below 10° F.) Type A
Fuller Mfg. Co. Torque Converter	SAE 10W	Type A (below 0° F.)
Borg-Warner Borg & Beck & Long Mfg. Co. All converters and hydraulic transmissions	Type A	Type A
Allison Division Torque Converters and Torqmatic Transmissions	Type C	Type C
Twin Disc Clutch Co. Hydraulic Reverse Gears Coupling or Power Take-off	SAE 10W	SAE 10W
Hydraulic Converter Transmissions Input shaft & impeller bearings (C, FC)	Same as Engine	
Fluid Medium except Two speed transmission and converter transmission combinations (Models T-DRR-FT-IT)	Type A	Type A
Reverse Transmissions Models RR-CRR-ICRR	SAE 40	SAE 20

NOTE: For all Grease applications on the above units a good high temperature grease should be used.

SECTION III OPERATING INSTRUCTIONS

The person operating the engine naturally assumes responsibility for its care while it is being operated. This is a very important responsibility since the care and attention given the engine goes a long way in determining how long a period it will operate satisfactorily before having to be shut down for repairs.

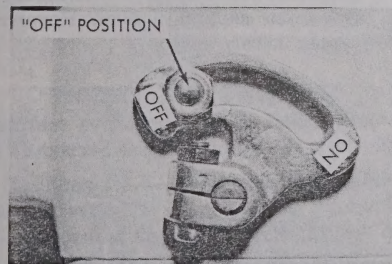
The operating and preventive maintenance instructions for the L-Head type engines are simple and should be followed without deviation.

The entire aim in setting forth these instructions is to give you the benefit of the knowledge and experience gained over a long period of collaboration between Engineering Research and Field Service.

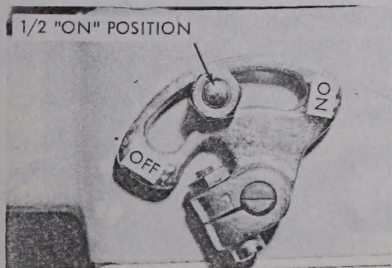
PREPARATION OF NEW ENGINE FOR OPERATION

Before placing a new engine in operation, it must be thoroughly inspected for external damage and particular attention paid to the following items:

1. **Inspect Engine Hold Down Bolts** — To make certain that they are firmly set.
2. **Manifold Heat Valve Setting** — The "F" series of industrial engines have an adjustable sector on the exhaust manifold which can provide added heat on the intake manifold for light operations with excessive idling.



Normal Operation



Low Speed - Light Load Operation

Figure 23 — Heat Valve Setting

NORMAL OPERATION

Set the sector on "OFF" position for warm weather operation, as there is enough heat on the intake manifold to properly vaporize the fuel.

CAUTION: Adding more heat will reduce the power.

LOW SPEED - LIGHT LOAD OPERATIONS

Set the sector at $\frac{1}{4}$ to $\frac{1}{2}$ "ON" position - or minimum position for good idling.

This setting provides added heat from the exhaust manifold to circulate around a section of the intake manifold and assist vaporization.

This setting results in some power loss - but will provide good idling and low speed operation with normal fuel - air ratio.

COLD WEATHER OPERATION

Set the sector to "FULL ON" position.

CAUTION: Tighten sector nut in correct position - so it will not loosen in operation.

3. **Open Fuel Tank Shut Off Valve**—By turning handle counter-clockwise as far as it will go.

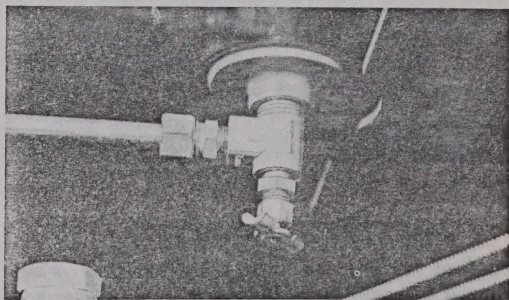


Figure 24 — Fuel Shut-off Valve

4. **Close water drain cock** — in lower radiator connection, also on the side of the block. (In some cases, this may be a pipe plug.)

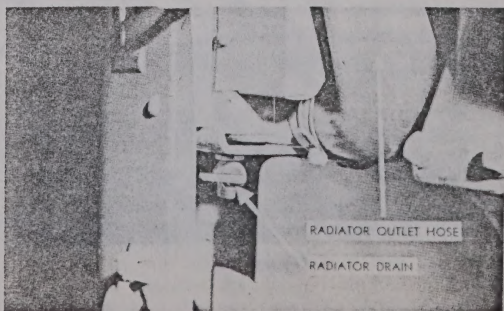


Figure 25 — Water Drain Cock

5. Fill Crankcase with oil shown in chart on page 14.

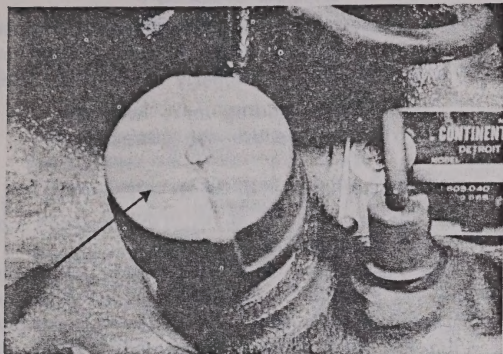


Figure 27

6. Fill Radiator with Clean Water — during freezing weather, use a sufficient amount of anti-freeze to protect the system for the lowest anticipated temperature — refer to Section V.

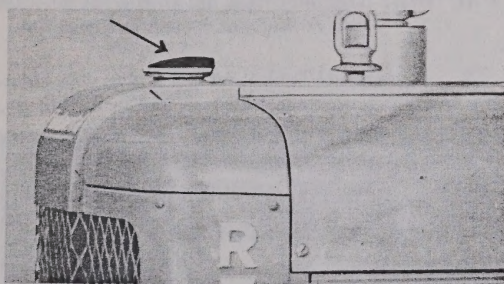


Figure 28

7. FILL GASOLINE TANK FULL — All new engines are shipped with a treated tank which should be completely diluted with a full tank of gasoline to eliminate any tendency to clog.

Be sure that the container used for filling is clean and free from dirt. Replace cap securely.

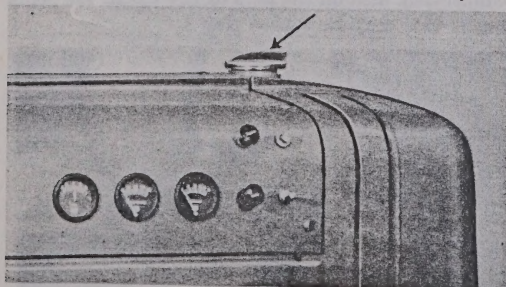


Figure 29

8. Engine Accessories — see that all points requiring lubrication are properly supplied.

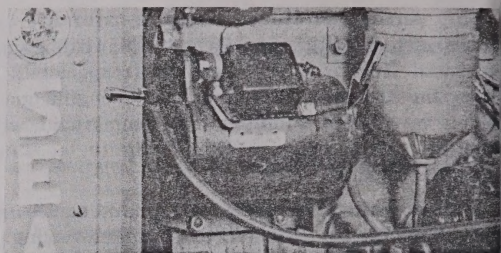


Figure 30

9. Electrical Connections — check storage battery terminals and all electrical connections. Check each spark plug wire for tightness.

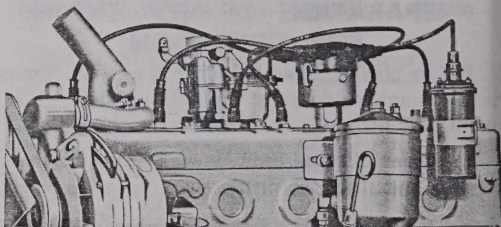


Figure 31

10. RADIATOR COOLANT CAPSULE — The radiator coolant capsule, which comes with the engine, is a water conditioner and anti rust inhibitor to protect the cooling system. Remove cellophane wrapper before using.

STARTING THE ENGINE

Normally check daily preventive maintenance schedule before starting. — (See Section IV).

1. Safety Control Switch — (If supplied) Turn Manual control knob with arrow pointing toward "on" position. When oil pressure builds up to normal, control knob will automatically release and arrow will point to "run" position.

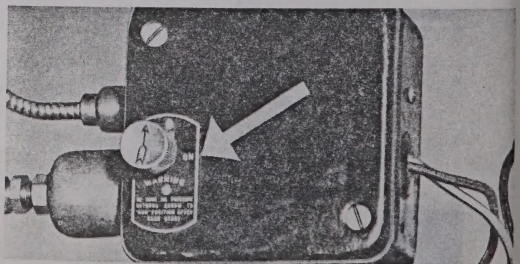


Figure 32 — Safety Switch

2. Disengage Power Take-Off — (if equipped)
Starting engine under load throws overload on starter and battery.

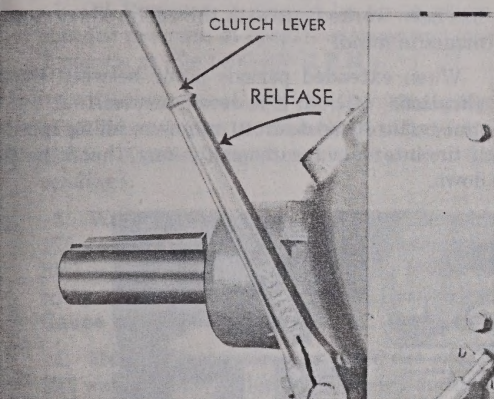


Figure 33 — Power Take-off

3. Open throttle Control about 1/3 open
4. Turn on Ignition Switch
5. Pull Out Choke (if manually operated)
But avoid flooding the engine. Operate the engine without choking as soon after starting as possible.
6. Push Starter Button In
Keep on until engine starts; but not longer than 15 seconds at a time.

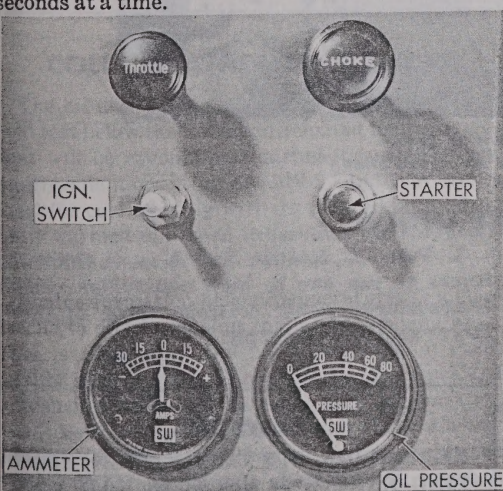


Figure 34 — Instrument Panel

7. Warm-up Before Applying Load
Idle the engine about 700 R.P.M. for a few minutes to circulate and warm oil — then increase the speed to approximately half throttle until the engine water reaches 100° F. This procedure will prolong the engine life.

8. Check Oil Pressure

MODEL	OIL PRESSURE
N Series	20-30#
F Series (with F400L00223 oil pressure relief spring)	20-30#
F Series (with 10EL00230 oil pressure relief spring)	30-40#
Y-M Series	30-40#
B Series	40-50#

*Refer to pages 5 & 6 for additional oil pressure information.

Figure 35 — Oil Pressure Chart
(Other pressures available for special Applications)

9. Check Water Temperature

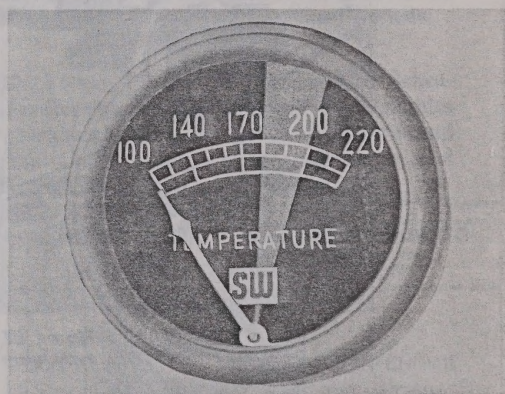


Figure 36 — Water Temperature Gauge

10. Check ignition timing

CAUTION:

After starting new engine — run it at idle for 5 minutes, then stop engine and recheck oil level in crankcase — then bring oil level to high mark on dipstick.

IMPORTANT!

Breaking in a new or rebuilt engine — for peak performance and economical operation, the following adjustments should be made at end of first 50 hrs. operation.

- 1) Torque down cylinder head studs to specifications.
- 2) Adjust valve tappets to specified clearances.
- 3) Adjust idle mixture and idle speed to 400-600 R.P.M.

SPEED CONTROL

The throttle control is used to close the carburetor butterfly valve to limit engine speed below governed speed.

Engines are provided with a mechanical or velocity governor set to maintain the load and speed specified when the engine is ordered. If individual requirements necessitate a change of governed speed — reset governor as outlined under

“Governor adjustment”, but do not exceed manufacturers recommended maximum speed, since this has been worked out with the end product requirements in mind.

When extended periods occur between the applications of load, it is recommended that the engine be throttled down to minimum idling speed or, if the intervals are unusually long, that it be shut down.

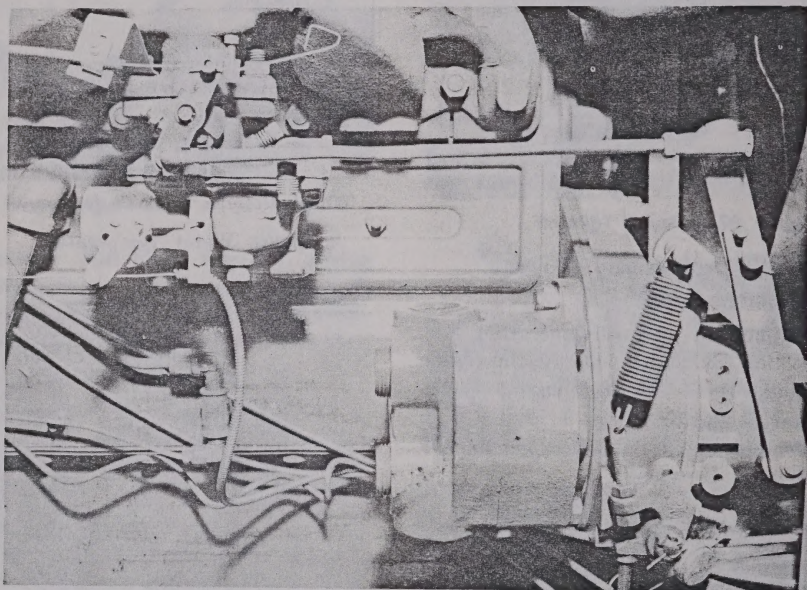


Figure 37 — Throttle Lever
(This may vary with the application.)

STOPPING THE ENGINE

1. Disengage Power Take-Off
2. Reduce engine Speed to Idle — If hot, run engine at idle (400-600) for several minutes to cool.

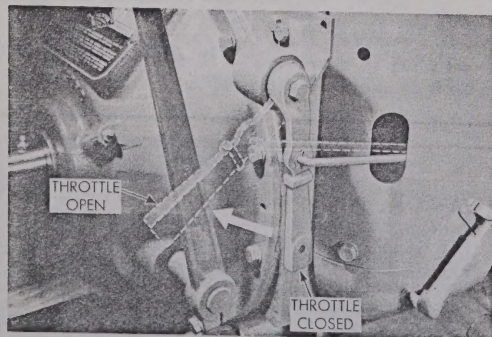


Figure 37A — Hand Throttle Control

3. Turn Off Ignition Switch — if engine continues to run due to high combustion chamber temperatures, either continue idling to further cool or shut off fuel supply.

CAUTION:

NEVER PULL OUT CHOKE WHEN STOPPING ENGINE — BECAUSE RAW GASOLINE WILL WASH LUBRICANT FROM CYLINDER WALLS.

10 OPERATING PRECAUTIONS

1. Oil Pressure — should be up to recommended pressure at operating speed and over 7 pounds at idle (400-600 R.P.M.)

2. Ammeter — should register "Charging" at all times engine is running. (A voltage regulator, if used, may limit it to a very low reading).

3. Water temperature — Normal operation 178 to 205° F. A pressure cap determines higher temperatures. Overheating is detected by loss of coolant. **"Frequent Readings of Gauge should become a Habit."**

4. Muffler Restriction — should not exceed 20" water or 1½" Mercury. Inspect mufflers periodically for restrictions to prevent burned valves.

5. Clean and Service Air Cleaner — as recommended to maintain its efficiency. The rapidity that dirt collects in the oil cup indicates how often the air cleaner should be serviced.

6. When engine is Over-Heated — do not add water — allow engine to cool so as to prevent cracking the cylinder head.

7. Engine Load Indication — a manifold vacuum of 6 inches of Mercury indicates the recommended maximum continuous full load operation and a vacuum of 18-20 inches of Mercury indicates normal idling vacuum. Between full load and idling, vacuum gauge readings may be used to approximate the percent. Any reading below 6" HG indicates engine is overloaded for continuous duty.

8. Avoid Cold-Sludge Condensation — by protecting unit to maintain crank case temperature over 135° F.

9. Idling engine — slow engine down to low idle (600 RPM) for about 5 minutes after each operating period before stopping. Too rapid cooling down may cause distortion. **Do not run at low idle for prolonged periods.**

10. Follow Preventive Maintenance Schedules Recommended — This will avoid troubles which might cause expensive breakdowns and maintain your engine for dependable and economical operation.

COLD WEATHER OPERATION

The oil used during cold weather should have a cold test below the lowest anticipated temperatures that will be encountered during its use. The new multigrade lubricating oils 5W-20 and 10W-30 are ideal for cold starting with its reduced initial drag until warmed up, when it assumes the characteristics of the heavier oil.

Sludge formation at low temperatures is a close second to dirt in causing engine damage and wear. This is formed by the piston combustion gases mixing with the fine oil mist in the crankcase and condensing on a cold surface. This condensation forms both a sulphuric and sulphurous acid which combines with the oil to become a highly injurious sludge. This dew point is about 135° F. — when crankcase temperatures are higher, the contaminated gases remain in gaseous form and the engine operates clean as long as a breather system is kept clean — however temperatures below this will result in injurious sludge formation. It is vitally important therefore to maintain oil and crankcase temperatures above 135° F., as shown on the following chart:

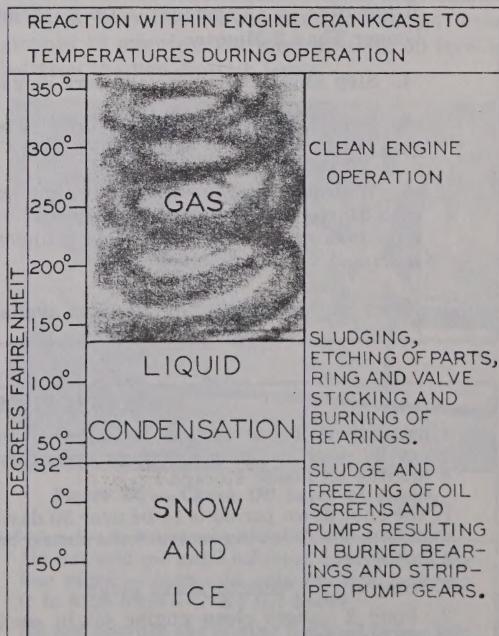


Figure 38

When sludging conditions prevail, the oil should be examined daily and changed as it may freeze, or clog the inlet strainer and cause bearing failures.

High Altitude Operation — High Altitude operation reduces the power output approximately $3\frac{1}{2}\%$ for every 1000 feet of altitude above sea level.

High Temperature Operation—for every 10° above 60° F. carburetor air temperature — a power loss of 1% results.

PREPARATION OF ENGINE FOR SEASONAL STORAGE

CAUTION

Before starting the processing, engine must be cooled down to the surrounding temperature, since oil will adhere much better to cold metal surfaces.

1. Drain Oil from Oil Pan — and replace drain plug.
2. Refill Oil Pan — with high grade SAE 30 or 40 engine oil to $\frac{1}{2}$ its normal capacity.
3. Start up Engine — and run at above 600 R.P.M. for 2 minutes to complete oil distribution on all surfaces — **Do Not Run Longer Than 2 Minutes.**
4. Stop Engine—Remove all Spark Plugs.
5. Pour 3 Ounces of SAE 30 or 40 Engine Oil — into each Spark Plug Hole.
6. With Ignition Cut Off — Crank engine with Starter — for at least a dozen revolutions to distribute this oil over the cylinder walls and valve mechanism.
7. Drain Oil from Pan and Reassemble Plug.
8. Drain Cooling System and Close Drain Cocks.
9. Drain All Gasoline — from tank, lines and carburetor bowl.
10. Replace All Spark Plugs.
11. Seal Air Cleaner Inlet — exhaust outlet — Crankcase Breather Tube — with weather proof masking tape.
12. Check Oil Filler Cap — Gas Tank Cap and Radiator Cap to make certain they are securely in place.

Note: If Mil-L21260 No. 30 oil is available, substitute in Steps 2 and 5 above.

SHORT TERM STORAGE

(Instructions below should be adhered to every 90 days on outside storage and every 6 months on inside storage.)

If the shut down period is to be over 30 days duration, the following instructions should be adhered to:

1. Stop engine, remove spark plugs.
2. Pour 3 ounces clean engine oil in each spark plug hole.
3. With ignition cut off, crank engine with starter at least a dozen revolutions to dis-

tribute this oil over the cylinder walls and valve mechanism.

4. Replace all spark plugs.
5. Remove drain plug from carburetor bowl, and drain gasoline.
6. Replace drain plugs.

CAUTION: Gasoline evaporates if left in carburetor for long periods. This evaporation of gasoline will leave a gum and varnish coating over jets and moving parts; when engine is started up again, you may have flooding or poor operation from carburetor.

SECTION IV PREVENTIVE MAINTENANCE

In order to obtain maximum efficiency from your gasoline engine, a definite maintenance program should be set-up and followed. Haphazard maintenance will only lead to faulty engine performance and shorten engine life.

All moving parts in the engine are subject to wear; however, wear can be retarded by careful operation and a planned maintenance program.

In general, gasoline engine operation demands careful attention to the cleanliness of air, fuel and oil and maintaining operating temperatures of 180°-200° F.

The following pages, covering DAILY, 50-250 and 500 hour maintenance, have been worked out with our field service division as "Minimum Requirements" to keep your engine in dependable operating condition.

DAILY

PREVENTIVE MAINTENANCE SCHEDULE

1. OVERALL VISUAL INSPECTION OF ENGINE

Look for evidence of fluid leaks on floor, cylinder head and block, indicating loose fuel, oil or water connections — tighten if found.

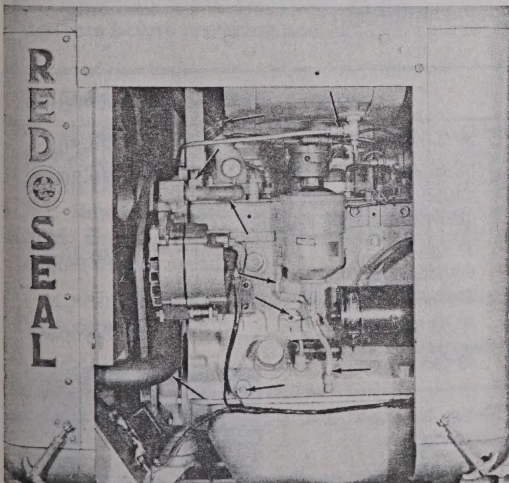


Figure 39 — Check for Possible Leakage

2. CHECK OIL LEVEL OF ENGINE

The dipstick indicates the high and low oil level in the crankcase—make allowance for additional oil drainage back into oil pan if engine has not been stopped 15 minutes. The most efficient oil level is between the two dipstick levels.

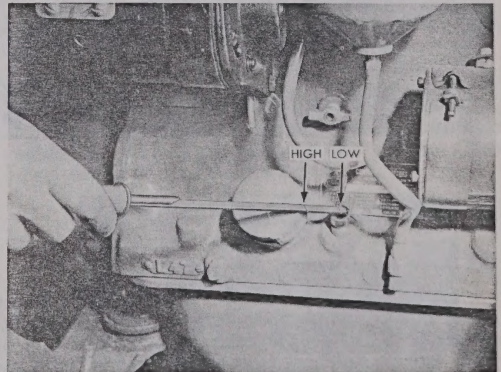


Figure 40 — Check Oil Level of Engine

Do not add oil until oil level approaches the low mark — then add only enough to bring it to high level — NEVER above.

Do not operate the engine with oil below low level mark.

3. CHECK RADIATOR

Fill radiator with clean water or anti-freeze to normal level maintained due to expansion when heated. Visually inspect fan and belt for condition and adjustment.

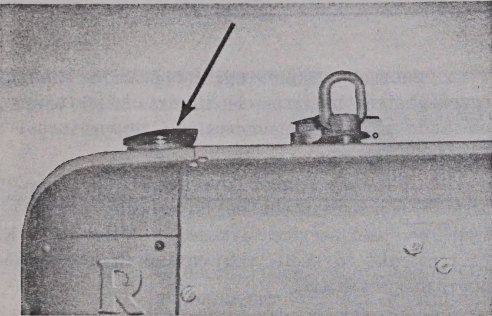


Figure 41

4. FILL FUEL TANK

Should be done at end of day's operation to prevent condensation forming in tank. Clean filler cap and area around spout before filling to prevent entrance of dust into fuel system.

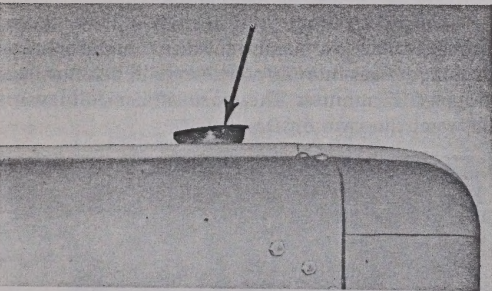


Figure 42

5. CHECK AIR CLEANER

Oil Bath Air Cleaner

Inspect daily or more often in extremely dusty conditions. Change oil and clean cup when oil becomes thick or 1/8 inch of dirt collects in bottom of cup. Always refill cup to exact oil level as indicated on the cup. Use SAE 20 oil in summer and SAE 10 oil or lighter in winter. Inspect all hoses, clamps and connections between air cleaner and engine. Tighten loose clamps and replace damaged hoses promptly.

Dry Type Air Cleaner

Under normal conditions, dry-type filters should be serviced every 50 hours of operation. Extreme

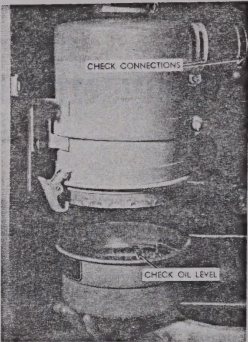


Figure 43 — Oil Bath Air Cleaner



Figure 43-A — Dry-Type Air Cleaner

conditions will require daily cleaning. Cartridge can be cleaned best by blowing compressed air from inside out. Do not apply air closer than 2 inches and don't use more than 50 pounds pressure. Do not damage gasket surface or bend outer screen. Cleaning can only be done a few times as the element will finally clog and restrict air flow. The cartridge must then be replaced.

6. CHECK OIL PRESSURE*

Note oil pressure gauge which should indicate the following pressure range at full throttle and a minimum of 7 pounds pressure at idling speed (400-600 R.P.M.) :

MODEL	OIL PRESSURE
N Series	20-30 #
F Series (with F400L00223 oil pressure relief spring)	20-30 #
F Series (with 10EL00230 oil pressure relief spring)	30-40 #
Y-M Series	30-40 #
B Series	40-50 #

*Refer to pages 5 & 6 for additional oil pressure information.

Figure 44 — Operating Oil Pressures

*Standard Engines: on some special customer specifications, this may change.

7. NOTE ANY UNUSUAL NOISE

Operators familiar with daily engine operation soon become alert to any noise not normally present. This is very valuable in correcting defects in the early stages and preventing expensive repairs or delays.

EVERY 50 HOURS

1. REPEAT DAILY OPERATIONS OUTLINED

Follow previous instructions.

2. CHANGE CRANKCASE OIL

Engine life is dependent upon clean oil being circulated to all moving parts; therefore, the frequency of oil changes and oil filter replacement is very important and should be made at regular, scheduled periods.

The schedule for changing oil is directly dependent upon the operational environment: an extremely clean operation could go 150 hours while a dirty operation (foundry or cement factory) could be 50 hours or less.

Replace the oil filter element every 150 hours unless extremely unfavorable operating conditions indicate that filter replacements should be made at every oil change period.

Thoroughly clean the filter, cover and sealing surfaces before replacing new element and gasket.

3. SERVICE AIR CLEANER

If oil-bath air cleaner is used, remove bottom half of air cleaner — clean thoroughly and fill with engine oil to oil level mark on cup, avoid overfilling. Replace cup and check all connections to manifold. Be sure that no unfiltered air can enter the engine intake manifold.

If a dry type air cleaner is used, clean element with compressed air.

(See Daily Instructions)

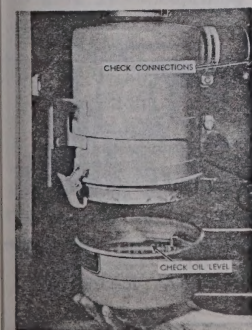


Figure 46 — Air Cleaner

4. CHECK FAN BELT TENSION

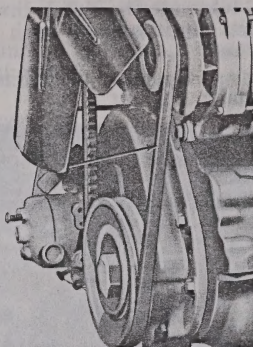


Figure 47 — Fan Belt Tension

Inspect wear condition of fan belt; note alignment and check belt tension which should allow not over $\frac{1}{2}$ " deflection on long span on narrow belts. (On wide belts the deflection should be between $\frac{3}{4}$ "-1".)

5. CHECK BATTERY

Check specific gravity of each cell — which should be at least 1.250. Add distilled water, if required, to raise level $\frac{3}{8}$ " above the separators.

Particular attention should be given battery during cold weather. The cranking power of a fully charged battery @ 80° F. is reduced 60% @ 0° F. — yet the power required to crank the engine is $2\frac{1}{2}$ times greater @ 0° F. than @ 80° F.



Figure 48 — Checking Battery

6. LUBRICATE GENERATOR AND STARTER

Apply 3-5 drops of engine oil to each cup on the generator and if required on the starter (Many starters have sealed bearings).

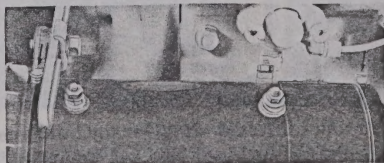


Figure 49 — Generator Lubrication

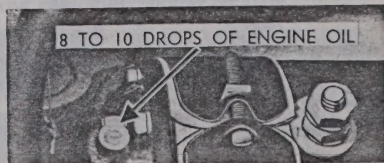


Figure 50 — Starter Lubrication Point

7. LUBRICATE POWER TAKE OFF

Using grease gun, lubricate the clutch throw-out bearing and output shaft bearing with approved ball bearing grease.

Operations requiring frequent de-clutching should be lubricated daily.



Figure 51

4. CLEAN SPARK PLUGS

Clean depressions around plugs before removing them — then clean and re-set point gap to .025 on standard plugs and .035 on resistor plugs.

Install spark plugs (18mm) and tighten to 35 ft. lbs. torque.

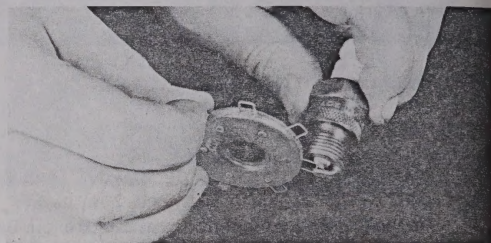
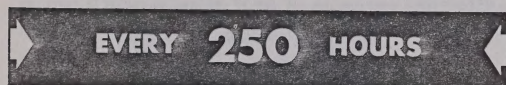


Figure 54

8. TORQUE DOWN CYLINDER HEAD TO SPECIFICATIONS IN MANUAL.**9. ADJUST IDLE MIXTURE AND IDLE SPEED TO 400-600 R. P. M. REPEAT AGAIN AT THE END OF 500 HOURS****1. REPEAT DAILY AND 50-HOUR SCHEDULES**

Follow previous instructions.

2. CLEAN EXTERIOR OF ENGINE

Use steam if available, otherwise any good commercial engine cleaner to wash down the engine.

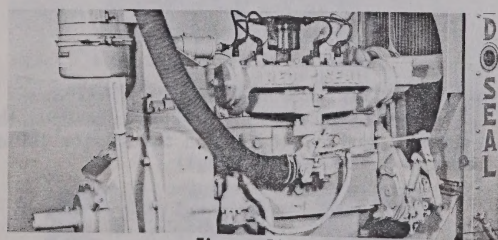


Figure 52

3. CHECK GOVERNOR CONTROL

Clean and lubricate all governor linkage to insure free operation of governor. Free-up any joints that may be binding or rods or levers that may be twisted. Check for full throttle opening.

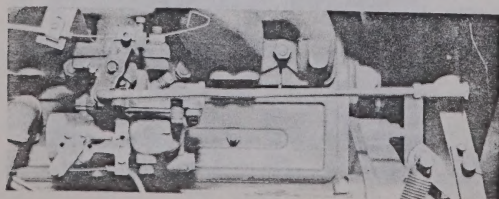


Figure 53

5. CHECK DISTRIBUTOR

Clean distributor cap inside and outside with solvent without removing wires and blow off with compressed air — inspect cap and rotor for cracks.

Examine contact surfaces of points — replace if burned or pitted and adjust to .020 gap.

Lubricate distributor cam sparingly.

Check distributor clamp bolts and if found loose — retiming the engine is necessary.

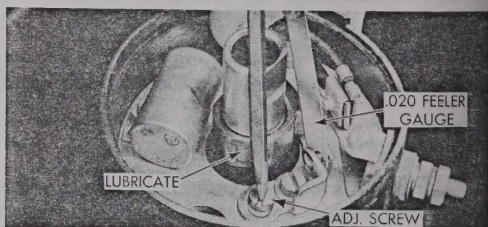


Figure 55

6. INSPECT IGNITION WIRES AND CONNECTIONS

Examine ignition wires for breaks in insulation, chafing and loose connections. Replace if defective.

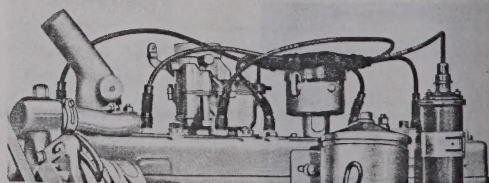


Figure 56

7 IF DRY REPLACEABLE ELEMENT AIR CLEANER IS USED, REPLACE ELEMENT.

EVERY 500 HOURS

1. REPEAT DAILY — 50 HOUR AND 250 HOUR SCHEDULES

2. COOLING SYSTEM

Clean radiator core by blowing out with compressed air.

Inspect radiator mounting.

Inspect water pump and connections for leaks.

Check fan and accessory drive belts.

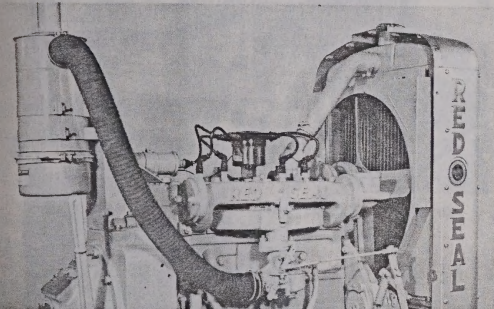


Figure 57

3. ADJUST VALVE TAPPET CLEARANCE

Check and adjust intake and exhaust valve tappets to following clearances at idling speed and running temperature:

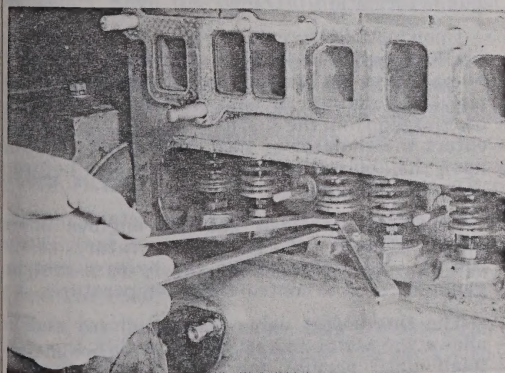


Figure 58 — Adjusting Valve Tappet Clearance

MODEL	INTAKE	EXHAUST
Y112, F135, F163	.012	.020
F227, F245	.012	.020
M330, M363	.017	.020
B427	.017	.022

Please check your engine nameplate for the correct setting.

NOTE: Tappet settings for previous models are listed on pages 5 & 6.

4. CARBURETOR

Clean exterior and check mounting to manifold.

Adjust carburetor air adjustment for even running and adjust idle speed to 400-600 R.P.M. minimum.

Inspect throttle and choke linkage for free operation.

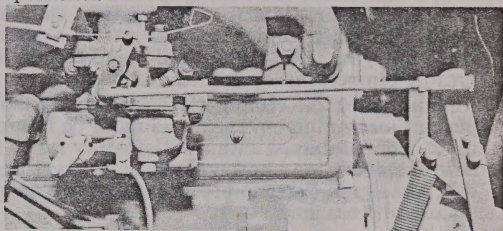


Figure 59 — Carburetor

5. FUEL PUMP

Clean Filter bowl and screen.

Inspect mounting and gasket.

Check all connections for leaks.

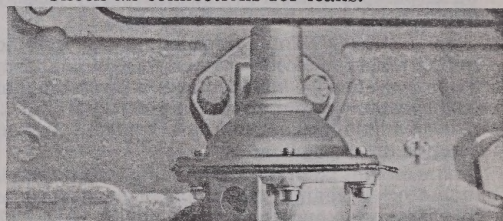


Figure 60 — Fuel Pump Mounting

6. MAGNETO (when equipped)

Spark test with engine operating by checking firing with each high tension cable held about 1/16" away from spark plug terminal.

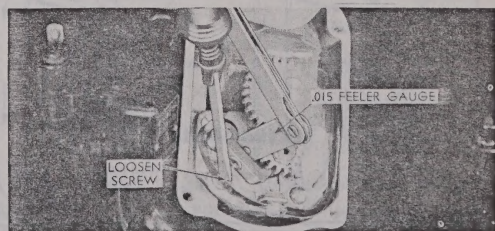


Figure 61

Remove end cap and examine carbon brushes for free-movement and inspect breaker points for wear and gap. Gap should be .015.

7. SAFETY AND THERMAL CONTROLS

Inspect control wires and connections.

Examine armored capillary tubing on water temperature element for visual damage that may cause faulty operation.

8. ADJUST IDLE MIXTURES AND IDLE SPEED TO 400-600 R. P. M.

SECTION V COOLING SYSTEM

The function of the cooling system is to prevent the temperatures in the combustion chamber, which may reach as high as 4000° F., from damaging the engine and at the same time keep the operating temperatures within safe limits.

Maintaining the cooling system efficiency is important, as engine temperatures must be brought up to and maintained within satisfactory range for efficient operation; however, must be kept from overheating, in order to prevent damage to valves, pistons and bearings.

CONTINENTAL L-HEAD COOLING SYSTEM

With the exception of some "N" and a few "Y" engine specifications, all Continental L-Head engines have the cooling water force-circulated by a water pump and use a thermostat and by-pass system to control the temperature range.

Some of the "N" and a few of the "Y" specifications circulate the cooling water using the Thermo-Syphon system — which requires no water pump or thermostat — but circulates the water from the resulting liquid expansion when heated and contraction during cooling.

The coolant from the water pump is first directed in the block against the exhaust valve seats and into passages connecting the cylinder head. This method provides the coldest water reaching the parts subjected to the highest temperatures.

The cylinder walls, in turn, are cooled their full length by convection currents only, which keeps

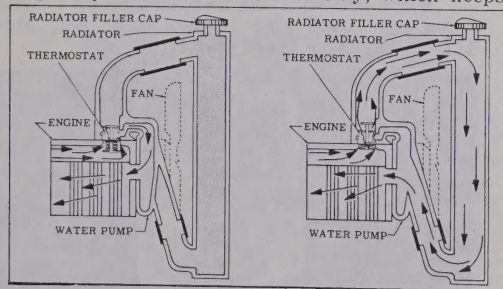


Figure 62 — Thermostat Flow Control
Thermostat Closed, Water Re-Circulating through Engine ONLY

Thermostat Open, Water Circulating through BOTH Engine and Radiator

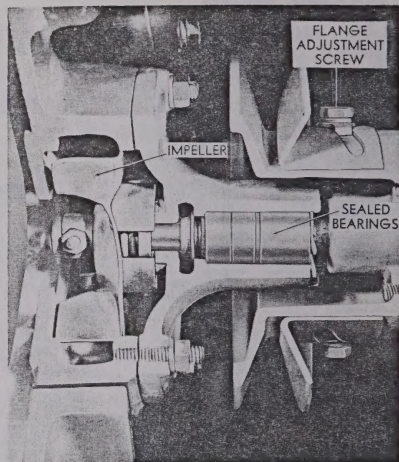


Figure 63 — Water Pump

the cylinder barrels at a more uniform temperature and thereby reduces crankcase oil dilution and sludge formation.

Upon leaving the cylinder head, the water enters the thermostat housing, in which is mounted the by-pass type thermostat, which controls the opening to the radiator or heat exchanger. Upon being discharged from the thermostat housing, the water enters the radiator or heat exchanger, depending upon the application, where it is cooled before re-entry into the engine.

Continental L-Head gasoline engines operate most efficiently with water temperatures of 180° to 200° F. and a thermostat and by-pass system generally used to control these temperatures.

The thermostat valve remains closed and only allows the water to recirculate within the engine itself until normal operating temperatures are reached. This provides for both rapid and even temperature increase of all engine parts during the warm-up period. When desired temperature is reached, the thermostat valve opens and allows the water to circulate through both the engine and radiator.

IMPORTANT

Present thermostats begin to open at 180° F. and are fully open at 202° F. Operation of engines in this temperature range is not harmful. However, temperature gauges are not always exactly accurate and may sometimes indicate higher than actual temperature. This can lead operators to believe engines are overheating when they are actually operating normally.

Overheating is always accompanied by loss of coolant water. In case of doubt, this should be checked.

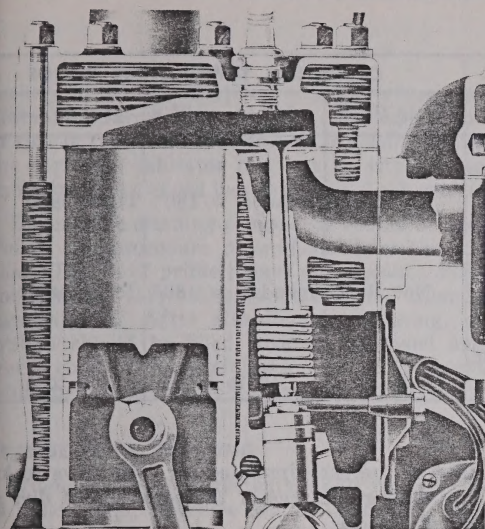


Figure 64 — Sectional View Showing Water Passages in head and block

EXPANSION OF WATER

Water has always been the most commonly used coolant for internal combustion engines because it has excellent heat transfer ability and is readily obtained everywhere. Like all liquids it expands when heated, the rate of expansion being $\frac{1}{4}$ pint per gallon when the temperature is raised from 40°F . to 180°F .

For example: If a 4 gallon cooling system is filled completely full of water at 40°F , 1 pint will be lost through the radiator overflow pipe by the time the water temperature reaches 180°F .

WATER FILTERS

In some areas, the chemical content of the water is such, that even the best of rust inhibitors will not protect the cooling system from the formation of rust and scale.

There are instances where this corrosive element has eaten holes through cast iron parts such as water pump impellers and bodies. This condition is caused by electrolysis taking place in the parts involved.

Where these conditions exist, water filters, such as those made by the Perry Co. and the Fram Corp., should be incorporated in the assembly to remove these troublesome elements and offset the electrolytic action.

EFFECT OF ALTITUDE ON COOLING

Water boils at 212°F under atmospheric pressure at sea level. This pressure becomes less

at higher altitudes and the reduced pressure causes water and other liquids to boil at a lower temperature. The following chart shows the effect on boiling point of water and anti-freeze solution:

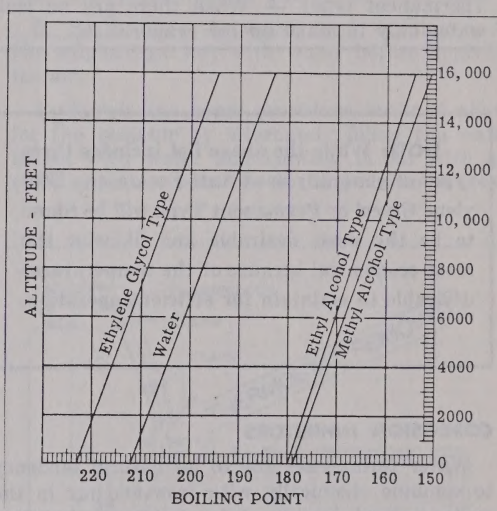


Figure 65 — Effect of Altitude on Boiling Point of Coolant

ANTI-FREEZES

Water freezes at 32°F ., forms solid ice and expands about 9% in volume — which causes tremendous pressure and serious damage when allowed to freeze inside the cooling system.

When operating temperatures are below 32°F . an anti-freeze liquid must be added which will lower the freezing point a safe margin below the anticipated temperature of outside air.

TYPES OF ANTI-FREEZE	OPERATING TEMPERATURE RANGE		
	32° to 10° F	+10° to -10° F	-10° to -30° F
PLAIN ALCOHOL — (evaporates easily)	Not Recommended w/180°	Thermostat	
METHYL ALCOHOL COMPOUNDS	Not Recommended w/180°	Thermostat	
ETHYLENE GLYCOL (permanent type) — When there are no leaks add water only to make up for evaporation.....	1 to 4	2 to 5	1 to 1

NOTE: While the above list includes three types of generally used Anti-Freeze, the Ethylene Glycol or Permanent Type will be found to be the most desirable and likewise the most economical because of the temperatures desirable to maintain for efficient operation.

CORROSION INHIBITORS

Water forms rust due to its natural tendency to combine chemically with iron and air in the system. Rust inhibitors for water are inexpensive, simple to use and make cleaning and flushing necessary only after long periods of operation.

The most commonly used is either a 3% addition of soluble oil or commercial corrosion inhibitor that is readily available at low cost. The addition of corrosion inhibitor is not necessary if an anti-freeze containing a rust inhibitor is used.

RADIATOR

The radiator or heat exchanger consists of a series of copper tubes through which the cooling water is circulated. In standard radiator design fins are connected to the copper tubes to give an extended surface through which heat can be dissipated. It is important that these tubes be kept clean on the inside and the fins free of dirt on the outside so that maximum heat transfer can take place in the radiator.

Blowing out between the fins of the radiator, using compressed air, in a direction opposite to

that of the fan circulated air, will serve to keep the cooling surfaces of the core free of dirt and other particles.

Every 500 hours of operation the radiator and cooling system should be well cleaned and flushed with clean water. (See Radiator Drain.)

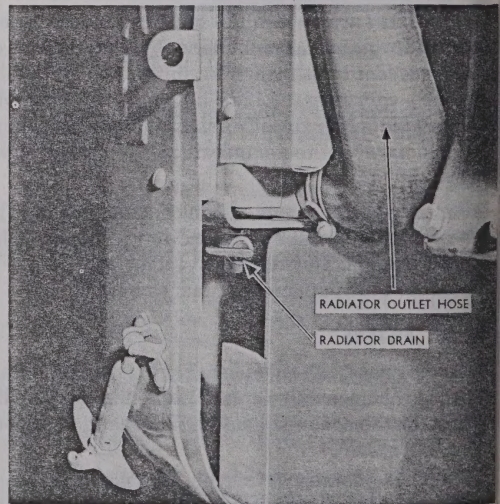


Figure 66 — Radiator Drain

Wherever possible, only soft clean water should be used in the cooling system. Hard water will cause scale to form in the radiator and the engine water jackets and cause poor heat transfer. Where the use of hard water cannot be avoided an approved water softener can be used.

CLEANING COOLING SYSTEM

Deposits of sludge, scale and rust on the cooling surfaces prevent normal heat transfer from the metal surfaces to the water and in time render the

cooling system ineffective to properly maintain normal operating temperatures. The appearance of rust in the radiator or coolant is a warning that the corrosion inhibitor has lost its effectiveness and should be cleaned before adding fresh coolant.

Dependable cleaning compounds should be used. Follow the procedure recommended by the supplier. This is of prime importance because different cleaners vary in concentration and chemical compositions. After cleaning and flushing, the system should be filled with an approved anti-freeze compound containing a rust and corrosion inhibitor or water with a corrosion inhibitor.

REVERSE FLOW FLUSHING

Whenever a cooling system is badly rust-clogged as indicated by overflow loss or abnormally high operating temperatures, corrective cleaning by reverse flow flushing will most effectively remove the heavy deposits of sludge, rust and scale. The reverse flow flushing should be performed immediately after draining the cleaning solution and it is advisable to flush the radiator first, allowing the engine to cool as much as possible.

Reverse flush the radiator, as follows:

1. Disconnect the hoses at the engine.
2. Put radiator cap on tight.
3. Clamp the flushing gun in the lower hose with a hose clamp.

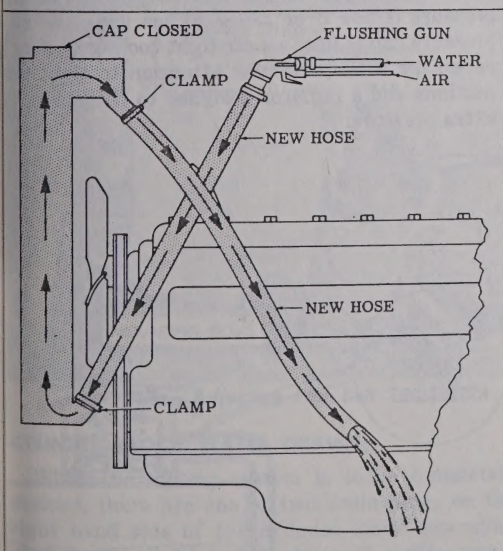


Figure 67 — Reverse Flushing Radiator

4. Turn on the water and let it fill the radiator.
5. Apply air pressure gradually, to avoid radiator damage.
6. Shut off the air, again fill the radiator with water and apply air pressure — repeat until the flushing stream runs out clear.
7. Clean and inspect radiator cap.

To Reverse flush the engine water Jacket

1. Remove the thermostat.
2. Clamp the flushing gun in the upper hose.
3. Partly close the water pump opening to fill the engine jacket with water before applying the air.
4. Follow the same procedure outlined above for the radiator by alternately filling the water jacket with water and blowing it out with air (80# pressure) until the flushing stream is clear.

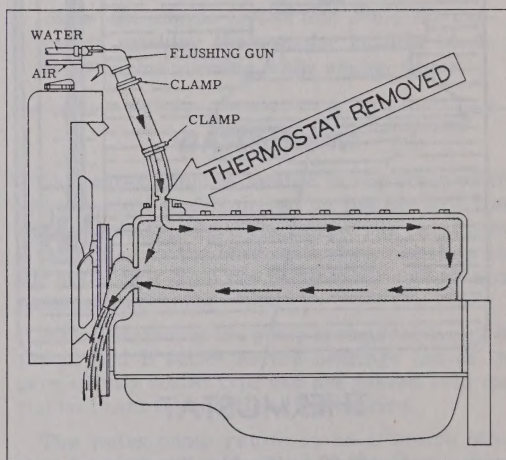


Figure 68 — Reverse Flushing Engine

TESTING THERMOSTAT

Remove Water Pump Header as shown in illustration. Before testing, clean and examine the bellows for rupture or distortion. If the valve can be pulled or pushed off its seat with only a slight effort when cold or it does not seat properly, the unit is defective and should be replaced.

The thermostatic operation can be checked in the following method:

1. Hang thermostat by its frame in a container of water so that it does not touch the bottom.
2. Heat the water and check temperature with a thermometer.

3. If the valve does not start to open at temperatures of 180°-200° F. or if it opens well before the 180° point is reached the thermostat should be replaced.

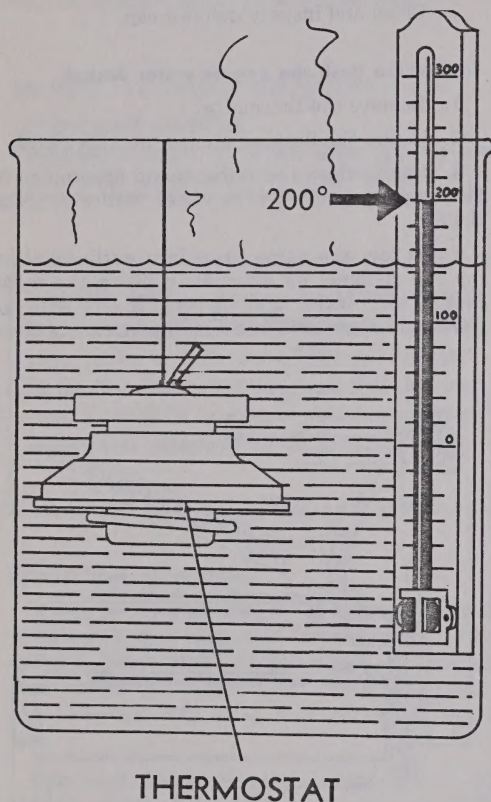


Figure 69 — Checking Thermostat

When replacing the thermostat in the water outlet elbow, be sure seal is in place, and seal seat as well as the counterbore is clean.

Assemble new gasket to pump body or spacer. Thermostat flange must seat in counterbore with gasket sealing contact between it and the pump body.

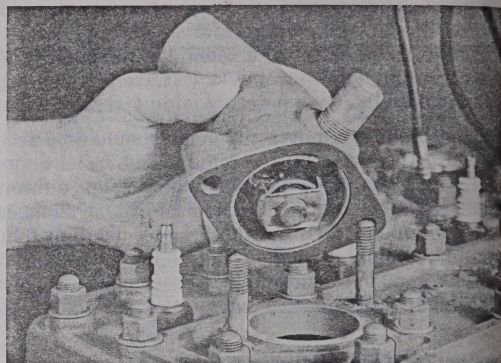


Figure 70 — Replacing Thermostat

RADIATOR PRESSURE CAP

Many operations use a pressure cap on the radiator to prevent overflow loss of water during normal operation. This spring loaded valve in the cap closes the outlet to the overflow pipe of the radiator and thus seals the system, so that pressure developing within the system raises the boiling point of the coolant and allows higher temperatures without overflow loss from boiling. Most pressure valves open at $4\frac{1}{2}$ or 7 pounds, allowing steam and water to pass out the overflow pipe, however, the boiling point of the coolant at this pressure is 224°F or 230°F at sea level. When a pressure cap is used an air tight cooling system is necessary with particular attention to tight connections and a radiator designed to withstand the extra pressure.

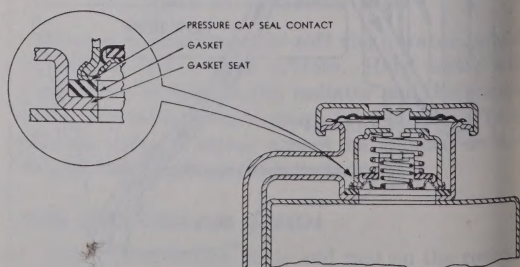


Figure 71 —

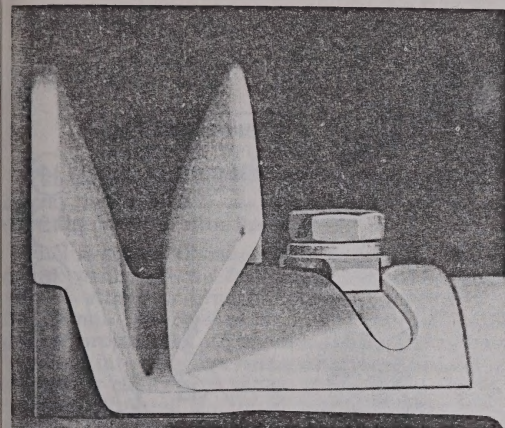


Figure 72 — Fan Belt Adjusting Flange

FAN BELT TENSION

When tightening fan belts, loosen the generator adjusting bolts and pull out on the generator by hand until the belt is just snug. Under no circumstances should a pry bar be used on the generator to obtain fan belt tension or damage to the bearings will result. Some engines have an adjustable fan pulley flange for belt adjustment.

When adjusted correctly the fan belt should have between $\frac{3}{4}$ " to 1" deflection on the long side. (On narrow belts this should not exceed $\frac{1}{2}$ ".)

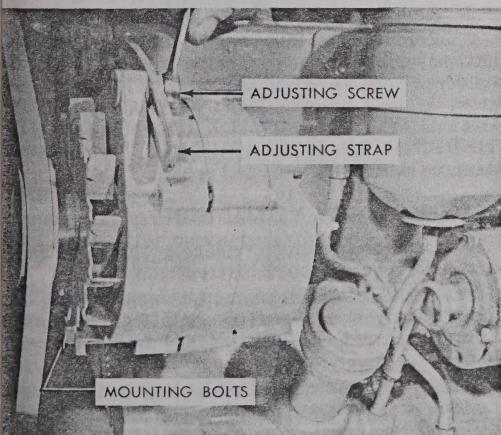


Figure 73 — Adjusting Fan Belt Tension

CYLINDER BLOCK WATER DRAINS

When the cooling system is to be completely drained, there are one or two drain plugs on the right hand side of the cylinder block depending upon engine models, which drain all cooling water which might be trapped in the base of the block.

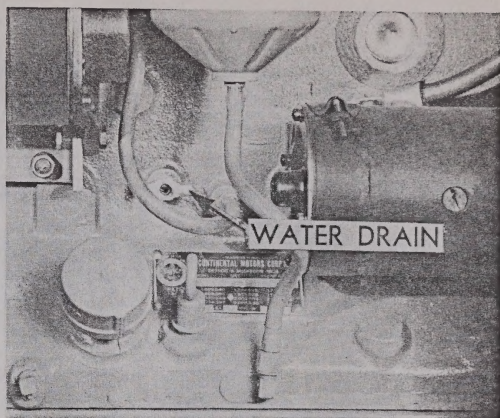


Figure 74 — Water Drain

CAUTION: OVERHEATED ENGINE

Never pour cold water or cold anti-freeze into the radiator of an overheated engine. Allow the engine to cool and avoid the danger of cracking the cylinder head or block. Keep engine running while adding water.

WATER PUMP

The water pump is located in the front of the cylinder block and is driven by the fan belt from the crankshaft pulley. The inlet of the water pump is connected to the lower radiator connection and the outlet flow from the pump is through integral passages cast in the block.

No lubrication of the pump is required except on the M and B series as the bearings are of the permanently sealed type and are packed with special lubricant for the life of the bearing.

The water pump requires no attention other than bearing replacement when they show excessive looseness or if a water leak develops which shows a damaged or badly worn seal that needs replacement.

COOLING SYSTEM PROTECTOR PELLET

All Continental engines are shipped with a cooling system protector pellet in the water outlet header. The pellet should be allowed to dissolve in the cooling system.

This pellet will dissolve in the cooling water with proven results as a rust inhibitor and water conditioner. It can be used with all types of anti-freeze.

ENGINE HOUSE VENTILATION

Engines operating inside buildings must be adequately ventilated to supply sufficient air to cool the engine — provide air to mix with the fuel and in addition, to carry the heated air from the building.

REMOVING WATER PUMP

The water pump assembly can be removed from the engine as a unit for service or repair in the following manner:

1. Remove fan by taking out four cap screws.
2. Loosen generator so that fan belt can be slacked off enough to slide over pulley.
3. Remove nuts and lockwashers holding the pump body to the front of the block and remove the pump assembly.

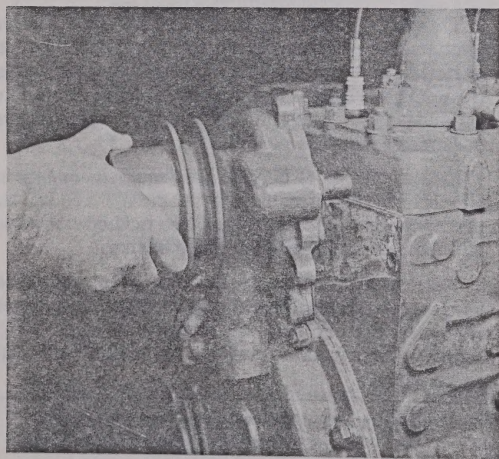


Figure 75 — Removing Water Pump

DISASSEMBLY OF WATER PUMP

When replacement of any internal parts becomes necessary, disassembly must be in the following sequence in order to prevent damage to the pump.

1. Before removing pump use puller to remove fan hub (17) from shaft.
2. Remove cap screws attaching pump to engine (20) (21).

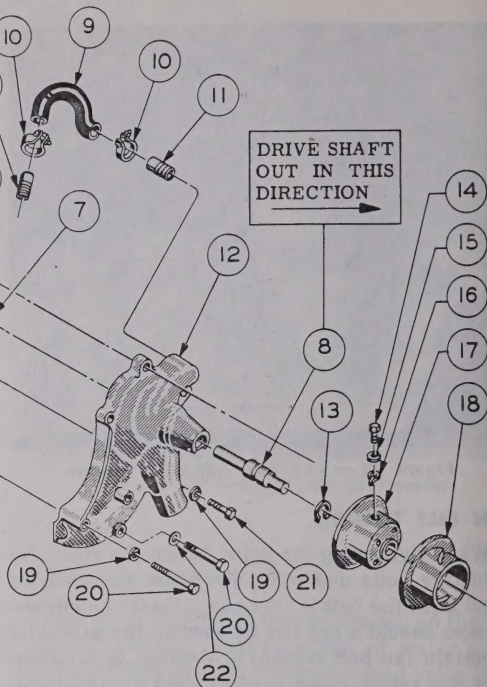


Figure 76 — Disassembling Water Pump

3. Remove countersunk screws (1) holding cover (2) removing cover and gasket.
4. Use puller to remove impeller (4) taking precautions to prevent damage to the casting.
5. Remove seal (5) and water shedder (6).
6. Remove lock ring (13) holding bearing and shaft assembly in body after which shaft (8) can be forced out through the front with an arbor press or lead hammer. **DO NOT ATTEMPT TO DRIVE WATER PUMP SHAFT (8) OUT THROUGH REAR OF HOUSING.** To do so will damage the housing beyond repair.

REASSEMBLY AND INSTALLATION

1. Reassemble pump, replacing worn or failed parts and reverse above instructions.

Seal contact surface must be smooth and flat. The bushing should be replaced, if scored or cut, but may be refaced or polished for further use, if not excessively worn or grooved.

A light film of lubricant applied to the face of the seal will facilitate seating and sealing.

2. Use thick soapsuds on both the seal and shaft when assembling in order to prevent damage to the seal.

3. Mount pump assembly on block using a new housing gasket.

4. Install fan belt and adjust belt tension to have $\frac{3}{4}$ " to 1" deflection on long side. (On narrow belts this should not exceed $\frac{1}{2}$ ".) Pull out the generator or alternator by hand, as bearing damage will result with a pry bar; in some cases this may be adjusted by the adjustable fan pulley.

SECTION VI FUEL SYSTEM

The basic purpose of the fuel system is to store, convey, mix fuel with air, then vaporize and introduce the mixture into the engine.

Fuel is stored in the gasoline tank; it is filtered and flows through the fuel supply line to the carburetor — either by gravity or under pressure of a fuel pump. The carburetor mixes the fuel with proper proportions of air and at the same time breaks it into very fine spray particles. This atomized spray changes to vapor, by absorbing heat as it travels through the intake manifold to the combustion chamber. Fuel must be vaporized since it will not burn well as a liquid.

GRAVITY FUEL SYSTEM

This is the most simple fuel system and is generally used on power units as it eliminates the need of a fuel pump — it only requires the fuel tank located higher than the carburetor.

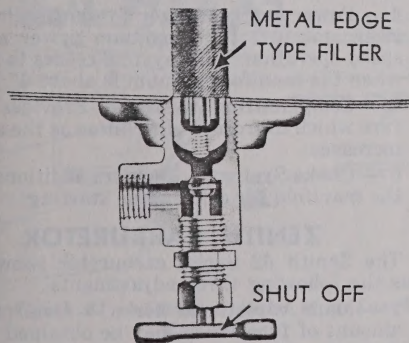


Figure 77 — Edge Type Filter

All power units with fuel tank have a combination shut-off valve and an efficient metal edge type filter. This filter prevents all foreign particles and water from entering the carburetor.

With reasonable care in filling the tank with clean fuel, this filter will require only seasonal cleaning of both the filter and tank.

CAUTION:

IT IS RECOMMENDED THAT THIS VALVE BE KEPT IN THE CLOSED POSITION EXCEPT WHEN UNIT IS IN OPERATION.

MECHANICAL FUEL PUMP

The Mechanical Fuel Pump is generally used when the fuel supply is below the level of the carburetor. They are of several models dependent upon the diaphragm diameter and assembly arrangement with fuel strainer bowl, air dome and manual primer.

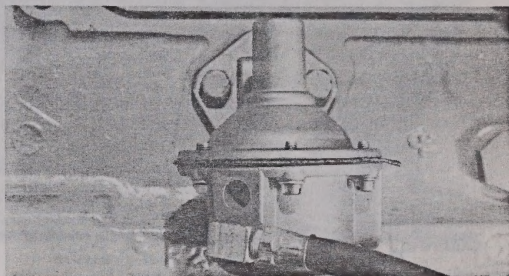


Figure 78 — Fuel Pump

This mechanical fuel pump mounts on the cylinder block pad and is driven by an eccentric on the engine camshaft contacting the fuel pump rocker arm.

Constant fuel pressure is maintained by an air dome and a pulsating diaphragm operated and controlled by linkage which adjusts itself to pressure demands.

Fuel Pump Tests — The fuel pressure may be measured by installing the pressure gauge between the fuel pump and carburetor.

The AC fuel pump size and static pressures @ 1800 R.P.M for the L-Head engines are.

ENGINE MODEL	DIAPHRAGM DIAMETER	FUEL PRESSURE	MAX. LIFT
N	3 1/4	1 1/2 - 2 3/4 #	10'
Y	3 1/4	2 - 2 3/4 #	10'
F	3 1/4	1 1/2 - 2 1/4 #	10'
M	3 7/8	3 - 4 1/2 #	10'
B	3 7/8	3 - 4 1/2 #	10'

When pressures are below the range, pump should be disassembled and reconditioned with the special overhaul kits available.

Maintenance — Fuel pump trouble is of only two kinds — either the pump is supplying too little gas or, in rare cases, too much.

If the pump is supplying too little gas, the engine either will not run or it will cough and falter. If too much gas — it will not idle smoothly or you will see gasoline dripping from the carburetor.

If the engine is getting too little gas — the trouble may be in the pump, fuel line or the gas tank. First, be sure there is gas in the tank, then disconnect the pump to carburetor line at the pump or carburetor, and turn the engine over a few times with the ignition off. If gas spurts from the pump or open end of the line — the pump, gasoline and tank are OK.

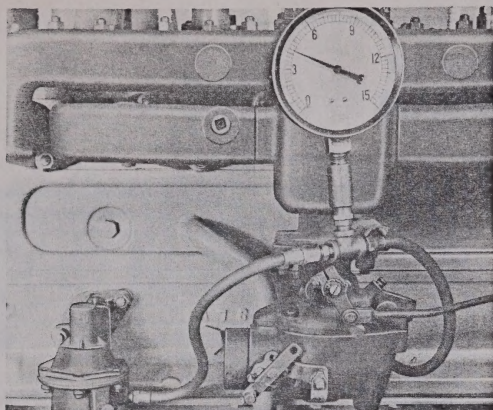


Figure 79 — Checking Fuel Pressure

If there is little or no flow—check the following:

1. Look for leaky bowl gasket or line connections — tighten them.
2. Remove and clean with solvent the gas strainer or screen inside the pump bowl.
3. Look for clogged fuel line — Blow out with compressed air.
4. Make sure that all pump cover screws and external plugs are tight.
5. Inspect flexible fuel line for deterioration, leaks, chafing, kinks or cracks. If none of these items restore proper flow — remove the pump for replacement or overhaul.

If getting too much gas — an oversupply of gasoline is generally caused by trouble other than the fuel pump — so first check the following:

1. Defective Automatic Choke.
2. Excessive use of hand choke.
3. Loosely connected fuel line, or loose carburetor assembly screws.
4. Punctured carburetor float.
5. Defective carburetor needle valve.
6. Improper carburetor adjustment.

If none of these items corrects flooding, remove the fuel pump for replacement or overhaul.

ELECTRIC FUEL PUMP

Many L-Head engines use electric fuel pumps operated from the storage battery supply. The pump should be mounted close to the fuel tank so as to provide fuel pressure at all points along the fuel line and so eliminate vapor lock.

The electric fuel pump is energized in the ignition circuit — which assures quick filling of the carburetor and fuel lines to effect easy starting.

When fuel pump trouble is suspected, disconnect the fuel line at the carburetor and turn on the ignition switch. Pump fuel into a small container, then place your finger on the outlet side of the fuel line. If the pump stops or ticks very infrequently, the pump and fuel line connections are satisfactory. Remove your finger from the outlet side of the fuel

line and if ample fuel flows — the pump is satisfactory.

If fuel does not flow and all connections are tight the pump should be replaced or repaired. Always be sure of a good ground and check for faulty flexible fuel lines and poor electrical connections.

CARBURETOR

Continental L-Head gasoline engines normally use various models of Zenith and Marvel-Schebler carburetors — of both the updraft and downdraft types.

The carburetor mixes fuel with air and meters the mixture into the engine as the power is demanded. Most carburetors incorporate the following systems to provide the flexibility and sensitive requirements of varying loads and conditions:

- 1 — **Float System** — Controls the level and supply of fuel.
- 2 — **Idle or Low Speed** — Furnishes the proper mixture for the engine idle, light load and slow speeds, until the main metering system takes over functions.
- 3 — **Main Metering System** — Controls the fuel mixture from part throttle operation to wide open throttle.
- 4 — **Power or Economizer System** — Provides richer mixture for maximum power and high speed operation. This system ceases to function when the manifold vacuum is above 6" Hg.
- 5 — **Compensating System** — Provides a mixture which decreases in richness as the air speed increases.
- 6 — **Choke System** — Delivers additional fuel to the manifold for cold engine starting.

ZENITH CARBURETOR

The Zenith 62 Series carburetor shown below has the following three adjustments:

- 1 — **Main Adjustment Screw** — Determines the amount of fuel which may be obtained for high speed operations.

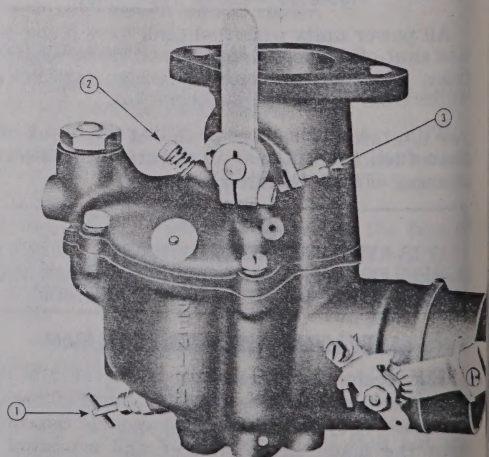


Figure 80 — Zenith 62 Series Carburetor

To set this adjustment, open the throttle to about $\frac{1}{4}$ open. Turn the adjustment clockwise, shutting off the fuel until the engine speed decreases or begins to miss due to lean mixture. Now open the adjustment until the engine reaches its maximum speed and runs smoothly without missing.

2 — Idle Mixture Adjustment Needle—Controls the amount of air admitted to the idling system, which functions only at low speeds.

Turning the screw clockwise cuts off the air, making the mixture richer — while unscrewing it admits more air making the mixture leaner. The idling adjustment needle should be set for the smoothest running of the engine; or, if a vacuum gauge can be attached to the manifold, set the adjustment for highest manifold vacuum.

3 — Idle Speed Adjustment Screw — controls the idling speed — which should be 400-600 R.P.M. for most industrial applications.

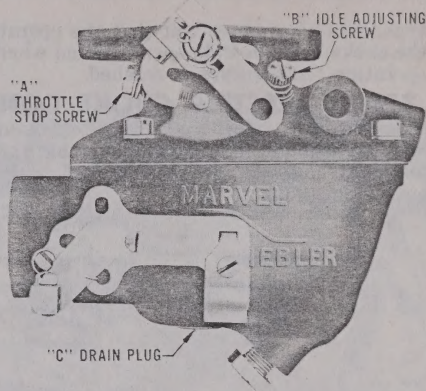


Figure 82 — Marvel-Schebler TSX Carburetor

4 — Close choke valve by means of choke control button.

5 — Start engine and partially release choke.

6 — After engine is up to operating temperature throughout, see that choke is returned to wide open position.

Low Speed or Idle Adjustment

1 — Set throttle or governor control lever in slow idle position.

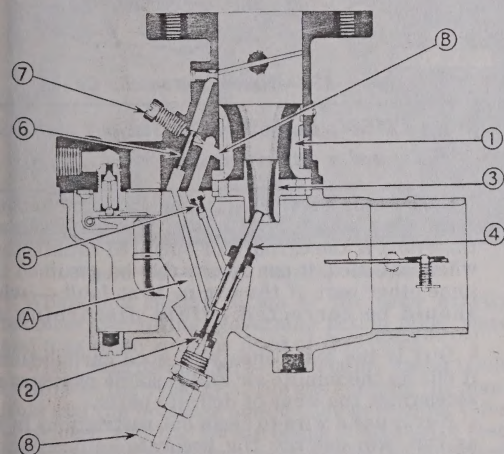


Figure 81 — Sectional View of a Zenith Carburetor

- No. 1. Venturi
- No. 2. Main Jet (High Speed)
- No. 3. Secondary Venturi
- No. 4. Main Discharge Jet
- No. 5. Well Vent
- No. 6. Idling Jet
- No. 7. Idle Adjusting Needle
- No. 8. Main Jet Adjustment
- A — Main Jet Channel
- B — Idle Channel

TSX-826

MARVEL-SCHLEBLER CARBURETOR 62-5

(Model TSX)

The Model TSX carburetor without power adjustment has the following two adjustments.

Preliminary Adjustments

1 — Set throttle stop screw "A" so that throttle disc is open slightly.

2 — Make certain that gasoline supply to carburetor is open.

3 — Set throttle control lever to $\frac{1}{3}$ open position.

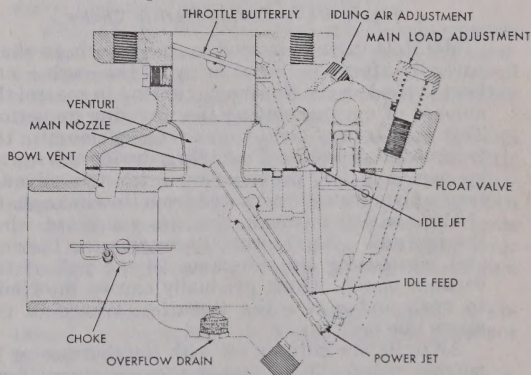


Figure 83 — Sectional View of the Marvel-Schebler Carburetor

2 — Adjust throttle stop screw "A" for correct engine idle speed (normally 400-600 RPM).

3 — Turn idle adjusting screw "B" in, or clockwise, until engine begins to falter or roll from richness, then turn screw "B" out, or counter-clockwise, until the engine runs smoothly.

NOTE: IT IS BETTER TO HAVE THIS ADJUSTMENT SLIGHTLY TOO RICH THAN TOO LEAN.

CARBURETOR CHOKES

Manually Operated Choke — is operated by a flexible cable control from the instrument panel or rear house panel. While this is the most simple

It is very important not to paint over the powdered bronze overflow drain plug shown in figure 83. This has to remain porous to drain off excess gasoline from over choking. If this plug is sealed, gas can back up into the air cleaner hose and create a fire hazard.

type, it is most important that the operator have the choke valve in wide open position when engine operating temperature is reached.

ZENITH ELECTRIC CHOKE CONTROL

Is made as part of the carburetor assembly. It is directly connected to the choke shaft and automatically controls the opening during the entire engine operation.

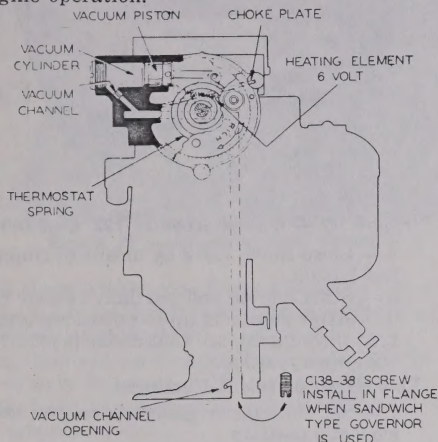


Figure 84 — Zenith Electric Choke

Manifold vacuum is used to open the choke shaft partially after the initial firing of the engine, and heat is used on the thermostat spring to control the amount of opening during the warming up period. This heat is provided by an electric element in the thermostat chamber. Fast idling during the warm-up period is also provided by a throttle advance mechanism which is actuated from the choke shaft.

The heating element which is energized when the ignition is "on" gradually warms the thermostat, decreasing its resistance to the pull of the vacuum piston, which gradually causes the choke to open and moves the throttle advance to the warm idle position.

All units are initially set with the thermostat 15 notches rich for 70° F. ambient temperature. Temperature corrections can be made by allowing one notch on the cover for each 5 degrees variation — making certain that the choke valve is fully open when operating temperatures are reached.

SISSON AUTOMATIC CHOKE

Uses an electro-magnet and a thermostat to automatically close the carburetor choke valve for cold starting and regulates its degree of opening as the engine warms.

The unit is mounted on the exhaust manifold and a small rod connects it to the carburetor choke lever. The electro-magnet is energized by the starter circuit which pulls an armature lever down, closing the choke valve.

As soon as the engine starts, the electro-magnet circuit is broken and then the thermostat provides automatic adjusting of the choke valve during the warming-up period.

The carburetor choke lever should be adjusted so that when the carburetor choke valve is closed

tight, there will be .015" to .020" clearance between the automatic choke lever and the field pole that serves as a stop. This measurement is taken at "C" and must be made with thermostatic control "B" pushed down as far as it will go.

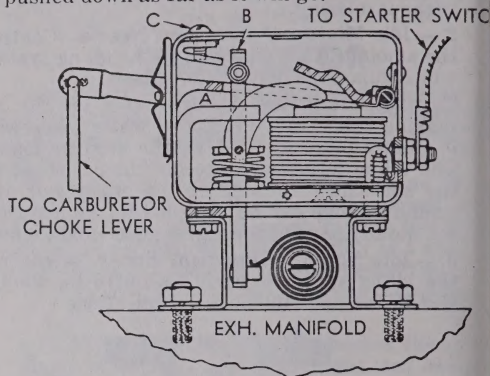


Figure 85 — Sisson Automatic Choke

CAUTION: Do not oil the Sisson automatic choke under any circumstance.

Carburetor Service — In general any change carburetor action will usually come gradually; therefore, if the carburetor operated satisfactorily when last used, it can reasonably be assumed that some other part of the engine is at fault — which should be corrected before disturbing the carburetor.

Dirt is the main enemy of good carburetion; it fills up the minute air and gasoline passages and accelerates the wear of delicate parts.

Never use a wire to clean out restrictions in jets as this will destroy the accurate calibrations of these parts — **always use compressed air**. The jets are made of brass to prevent rust and corrosion and a wire would cut or ream the hole in the jet and ruin it.

Maintaining correct fuel level in the carburetor bowl is important — as the fuel flow through the jets is naturally affected by the amount of fuel in the bowl.

After a carburetor has been in service for some time, the holes in the jets and the float valve and seat become worn from the constant flow of fuel through them and should be overhauled by a competent carburetor service station.

Do not experiment with other size jets or any so-called fuel-saving gadgets as your arrangement has been thoroughly tested on a dynamometer program.

GOVERNORS

The governor is a device which controls engine speed — either keeping it operating at a constant speed or preventing it from exceeding a predetermined speed. It promotes engine operation economy and eliminates needless engine failures.

Continental L-Head engines use many types of velocity and centrifugal governors — however the majority use centrifugal (Mechanical) governors

VELOCITY GOVERNORS

Velocity Governors — are generally used to prevent engine speed from exceeding a predetermined maximum. The governor is mounted between the carburetor and manifold flanges. In its most simple form, it consists of a main body, which contains a throttle shaft, a throttle valve and a main governor spring. The main governor spring is attached by linkage to the governor shaft and the spring force holds the throttle valve open.

When the engine is started, air flows through the carburetor throat and the governor throat. The velocity of the air creates a pressure above the throttle valve. When this pressure exceeds the force exerted by the spring, the throttle will move toward a closed position. The adjusting screw varies the spring tension.

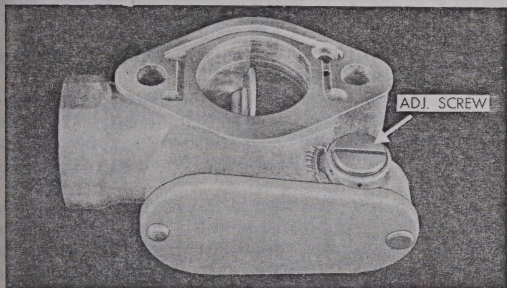


Figure 86 — Hoof Velocity Governor

When this closing action of the valve exactly balances the spring, governing action takes place and maximum speed is fixed at this point.

When load is applied — the engine speed tends to drop — the velocity of the gas through the manifold and the pressure against the governing valve is reduced and the spring opens the valve to feed more gasoline to the engine to handle the increased load demand. Thus an almost constant speed is maintained whether the engine is running with or without load.

CHECKING AND ADJUSTING GOVERNOR LINKAGE

The following is a step by step procedure to follow in checking and adjusting the governor linkage:

- 1 — With the engine stopped and spring tension about normal, the governor should hold the throttle in the open position. The governor to carburetor control rod should be adjusted in length so the throttle stop lever is $\frac{1}{64}$ to $\frac{1}{32}$ off the stop pin.
- 2 — Make certain that all linkage is free with spring at operating tension disconnect the governor spring and check movement of levers and rods.
- 3 — The hinged lever governor eliminates the need for a spring loaded throttle lever on the carburetor. As the carburetor lever is forced to idle position by the speed control lever, this in turn pivots the top half of the governor arm forward, slowing the engine to idle. (See Figure 87.)

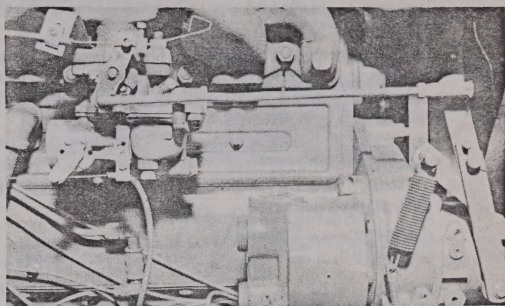


Figure 87 — Governor Linkage

CONTINENTAL GOVERNORS

The **Continental Governor** — is used on most industrial units requiring normal industrial speed regulation. These governors differ from conventional centrifugal governors mainly in that round steel balls are used as the motivating force producer instead of masses of weight.

When the governor is driven at increasing speeds by the engine through the governor gear, the hardened steel balls, move outward, forcing the conical upper race, fork base, fork and lever assembly toward a closed throttle position.

An externally mounted spring imposes tension on the lever assembly toward the open throttle position. As the engine speed increases, the centrifugal force created by the balls will increase until a balanced condition between the governor force and the spring force exists and the governing lever remains stationary — holding a constant engine R.P.M.

Adjustment — The desired engine speed is obtained by increasing or decreasing the governor spring tension.

WARNING!

Disconnect Fan before making Governor adjustments

CONSTANT SPEED GOVERNOR

- 1 — Start the engine. While it is warming up, back out surge adjusting screw "C" (Figure 88) so it will have no effect.
- 2 — With engine warmed up, adjust idle speed approximately 150 R.P.M. higher than the required speed under load, by turning screw "B" in or out, thus either increasing or decreasing pull on the spring.
 - ✦ Lock screw "A" should be backed out so as not to interfere with the adjustment.
- 3 — Apply the desired load, and readjust screw "B" in order to obtain the required speed under load. Release load and note R.P.M. at which engine settles out. Again apply load, and observe the drop in R.P.M. before governor opens throttle to compensate.

- 4 — The range of a governor's action is indicated by the differential between R.P.M. under load and that under no load. This can be varied and the sensitivity of governor changed by changing the length of screw "E".
- 5 — To broaden the range of the governor and produce a more stable action, lengthen screw "E" and compensate for this change by turning screw "B" in to restore speed. Lengthening screw "E" changes pull on spring to more nearly the arc of the lever action, thus having the effect of increasing the spring rate.

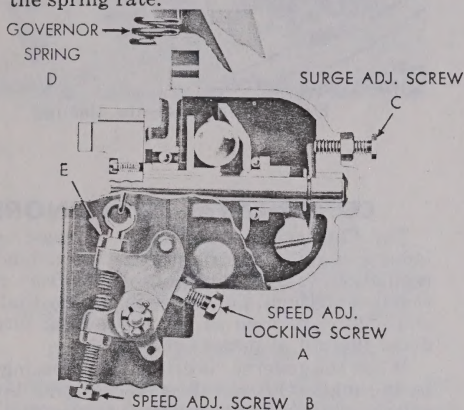
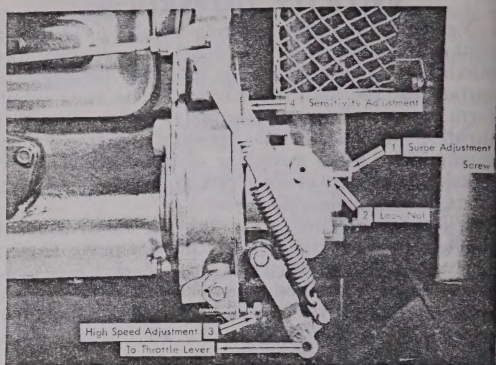


Figure 88 — Governor



Variable-Speed Governor

- 4 — Check Regulation — by applying and removing engine load.
 - (1) If regulation is too broad — increase spring tension with sensitivity screw "4" and readjust high speed screw "3" throttle stop to obtain high idle speed.
 - (2) If regulation is too narrow — decrease spring tension with sensitivity screw "4" and readjust high speed screw "3" throttle stop to obtain desired high idle speed.
 - (3) If governor surges under load — decrease spring tension with sensitivity screw "4" and readjust throttle lever position to desired high idle speed.
 - (4) Repeat above steps as required — until desired performance is obtained. When adjustment is complete, lock all lock nuts to maintain settings.

Surge Screw "1" — is used to remove a no-load surge only

If governor surges at no-load, turn surge screw in a turn at a time until the surge is removed. Do not turn in far enough to increase the no-load speed more than a few RPM, if at all.

- 6 — To narrow the range and increase the sensitivity of the governor, reverse procedure outlined in 5. (Changing the length of screw "E" has the same effect as using a stronger or weaker spring.)
- 7 — With the governor adjusted for desired performance, release the load and allow engine to run at governed speed, no load. If a surge is noted, turn surge adjusting screw "C" in or clockwise until surge is eliminated. Do not turn in further than necessary as it may make it difficult to get a low enough slow idle.
Alternate method if a tachometer is used: have engine running at high idle (governed speed) no load. Turn surge adjusting screw in until R.P.M. increases 10-20 R.P.M. and lock. If linkage and carburetor are all properly adjusted, surge will be gone.
- 8 — When governor adjustment is completed, tighten locking screw "A", which locks the cam in position. Then make sure that all lock nuts are tight, in order to maintain the adjustment.

VARIABLE SPEED GOVERNOR

- 1 — Back Out Surge Screw "1" — until only 3-4 threads hold — then lock with lock nut "2".
- 2 — Start Engine and Idle — until warmed to operating temperature.
- 3 — Set Specified High Idle No-Load Speed — by moving throttle to required position and adjusting high speed screw "3".

Maintenance — The slotted driver, in which the balls move, is pinned to the governor shaft; the two races are free floating on the shaft. When the engine is running at a fixed speed all parts go around with the governor shaft and the thrust is taken on the thrust bearing between conical shaped race and fork base. When a change in speed, due to change in load, takes place, the relative speed between the balls and races is changed. Consequently, wear is distributed over the entire operating surface of the races and balls. Since the surfaces are hardened, little or no wear other than a polish should ever take place on these parts.

The driver must always be tight to the shaft. The races must be free on the shaft.

In assembly of the governor a space of .004 to .006 is provided between the driver and the flat race. This is to assure freedom for movement of the flat race. When servicing the governor, make sure that both races revolve freely on the shaft.

When the balls are "in", that is in the bottom of the driver slots, the space between the top of the conical shaped race bushing and hairpin clip should be .230-.240. Use .010 spacer washers to obtain required space.

The governor shaft is pressed into gear and secured with screw that is partially in the shaft and partially in gear.

Lubrication is supplied the governor by splash from the front end gear train through holes provided in the governor base. Like all mechanical governors, it must have ample lubrication for its functioning. Make sure the governor parts are being well supplied with oil.

HINGED LEVER GOVERNOR

The Continental hinged lever governors are basically the same as other Continental Governors, except the governor arm is in two parts. Pivoted on a pivot bolt, it is spring loaded to hold the arm in a straight position except when low idle is desired. (Figure 88A.)

When carburetor lever is forced to idle position by speed control lever, this in turn pivots top half of governor arm forward.

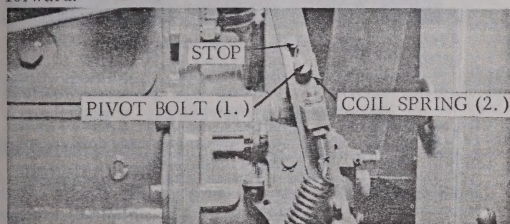


Figure 88A

On older models, a small coil spring loaded throttle lever and shaft on carburetor was used to get idle position. (Figure 88B.)

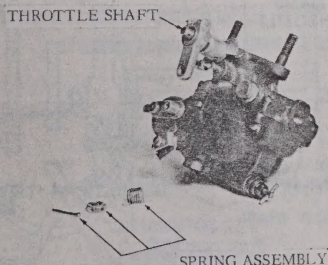


Figure 88B

Should a hinged lever governor be used with a spring loaded throttle lever, the cotter key (Figure 88C) should be removed and coil spring wound up as tight as possible, counter clockwise, by turning serrated nut (Figure 88D) until it lines up with nearest hole in nut and carburetor shaft and then reinstall cotter key. This governor can be supplied as constant speed or variable speed.

Governor adjustments are the same as previously explained under Governor adjustments.

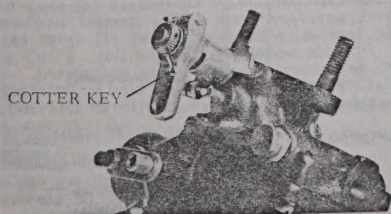


Figure 88C

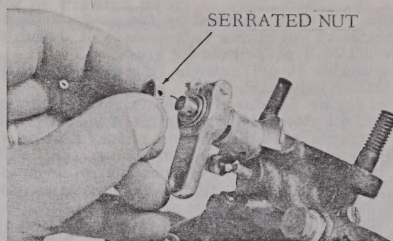


Figure 88D

PIERCE GOVERNORS

Pierce Centrifugal Governors — are used for many close generator applications and also as tailshaft governors on torque converter installations.

Governors for engines driving generators are of the constant speed type — which provide close regulation at a fixed speed to prevent excessive frequency variation. Close regulation with a single spring and weights is possible only in a short range of engine speeds — not exceeding 400 R.P.M. The reason for this is that the forces of the governor spring and weights do not increase and decrease at the same rate.

Operation (See Fig. 90) — Pierce governors operate as follows:

The governor shaft (10) is driven by gears (1). The shaft is mounted on a heavy-duty radial ball bearing (3) to minimize friction and wear. On the main shaft is a spider (4) which supports two governor weights (6). The weight noses (2) rest against a hardened thrust sleeve (14) with thrust bearing (8).

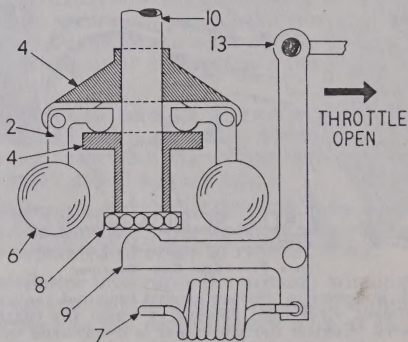


Figure 89 — Schematic Drawing of a Pierce Centrifugal Governor

In operation, the governor shaft turns with the engine. As the shaft rotates, the centrifugal energy developed in

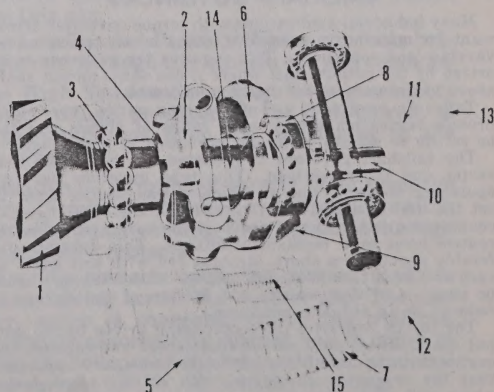


Figure 90 — Sectional Drawing of a Pierce Centrifugal Governor

the weights (6) causes them to swing outward on their pivots — this energy is opposed by the governor spring (7). The tension of this spring is the means of setting the governor to act at a predetermined speed.

When the engine is not running, the governor spring holds the throttle valve wide open.

When the engine is started, the weights swing out, moving the thrust sleeve (14) along the driveshaft. This movement is transmitted through the thrust bearing (8) to the rocker yoke (9) on the throttle lever shaft. This movement, in turn, moves the governor control lever (13) toward the closed throttle position. The weights continue to move out until the weight force and spring force are in balance — when the throttle will be in position to maintain the governed R.P.M.

Adjustment

1 — The speed of the Governor is regulated by adjusting screw (15).

2 — Sensitivity of the governor can be regulated, by auxiliary adjusting screw (12). Surging or hunting under load conditions can usually be eliminated by broadening the regulation with this adjusting screw.

3 — No Load Surge — is eliminated by means of the bumper screw (11) at no load-open throttle position.

CAM GEAR GOVERNOR

Some L-head engines use the Continental designed "built-in" cam gear driven governor. Sealed, dust proof and engine lubricated, it is compact and easily adjusted. The control shaft floats on two needle bearings to remove friction for closer, more accurate control through the whole power range.

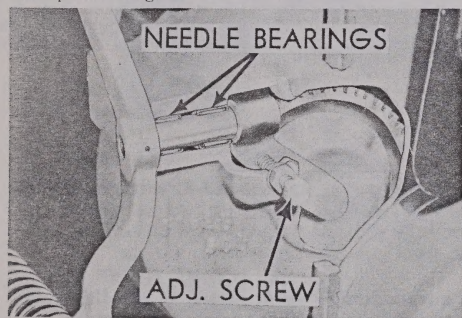


Figure 91 — Cam Gear Governor

This governor is a variable speed type and has no speed adjustment other than amount of travel the control rod is moved. Control rod movement is determined by accelerator pedal or hand control linkages. Idle surge adjusting screw should be adjusted in just enough to eliminate any tendency of engine to surge.

TAILSHAFT GOVERNORS

Many industrial applications with torque converter drives want to maintain a constant output shaft speed under varying load conditions. This requires the governor to be driven by the output shaft where it can sense output shaft speed variations rather than engine speed.

Tailshaft governors are of the long range type which provide regulation over a wide range of speeds and can be set up to maintain any desired speed in that range.

The tailshaft governor is mounted on the torque converter and is gear-driven. This type governor has two operating levers — one of which is the throttle lever to set the desired output shaft speed and the other lever is connected directly to and operates the carburetor throttle control lever by a mechanical linkage. This linkage, preferably should be a short, straight rod with ball joints at each end or if the linkage is long — walled tubing should be used — so that weight and friction of the linkage is reduced to an absolute minimum.

The torque converter governor, being driven by the output shaft, senses only output shaft speed and controls the engine throttle accordingly. It is therefore very important that the engine be protected, with an overspeed device which will sense engine speed and limit that speed to a

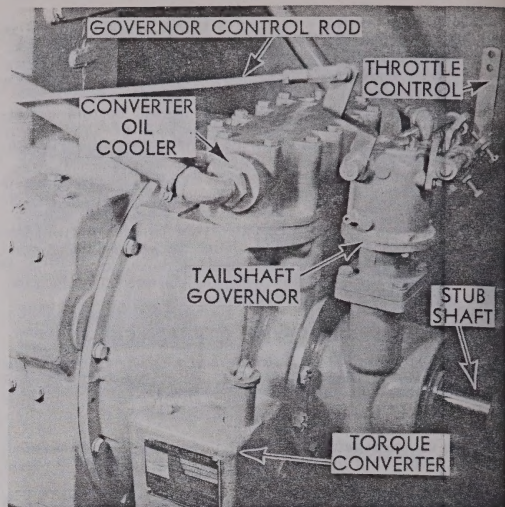


Figure 92 — Tailshaft Governor

safe maximum. This protection may be obtained with a mechanical, electrical or velocity type governor whichever may be the most simple arrangement.

Adjustments — include the following:

(A) High Idle Speed — Limits maximum engine speed, follow manufacturers recommendations.

(B) Low Idle Speed — Limits engine idling speed — 400-600 R.P.M.

(C) Sensitivity Adjustment — will eliminate surging or hunting by broadening regulation.

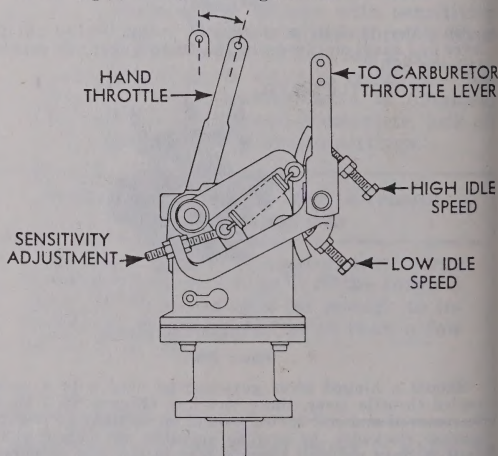


Figure 92A — Tailshaft Governor Adjustments

The hook-up of governor lever to carburetor lever should be done in the following manner:

1. Make sure carburetor shaft does not stick nor bind.
2. With governor lever in its normal position under spring tension, with engine shut off, with carburetor lever in wide open throttle position, a rod of exact length to connect the two levers is inserted.
3. Make sure that there is no bind or sticking in the assembly of rods and levers. **THIS IS IMPORTANT.**

IMPORTANT:

Pressure lubricated line must be connected to the torque converter or supply with an orifice.

Governor control linkage must be absolutely free to obtain correct governor operation.

SECTION VII IGNITION

Continental L-Head engines are equipped with either battery ignition or magneto ignition. Both systems consist of an induction coil; breaker points, with a condenser connected across the points to absorb any arcing, and a distributor which connects to each spark plug. The main difference is that the battery-ignition system requires a storage battery and the magneto system is the engine to supply energy to rotate a permanent magnet armature.

The ignition system has the job of producing and delivering high voltage surges of about 20,000 volts to the correct spark plug, at the correct interval and with the correct timing to the engine. Each voltage surge produces a spark at the spark plug gap to which it is delivered, so that the mixture of air and fuel in the cylinder is ignited.

BATTERY-IGNITION SYSTEM

This battery-ignition circuit consists of the battery, ammeter, ignition-switch, ignition coil, distributor, spark plugs and low and high tension wiring.

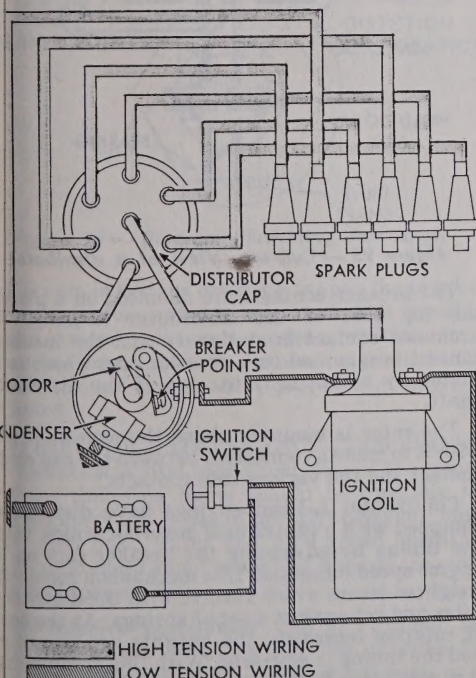


Figure 93 — Schematic drawing of battery ignition system

These parts can be divided into separate circuits consisting of a low tension circuit carrying battery voltage and a high tension spark circuit of about 20,000 volts.

The low tension primary circuit consists of the battery, ammeter, ignition switch, primary winding of the ignition coil, distributor contacts and condenser, and the primary wiring.

The secondary high tension circuit includes the coil secondary winding, distributor cap and rotor, spark plugs, and high tension wiring.

IGNITION SYSTEM COMPONENTS

The **Battery** supplies the voltage for producing a current flow through the ignition circuit.

The **Ammeter** indicates the amount and direction of current flow.

The **Ignition Switch** is an "Off" and "On" switch and the **Breaker Contacts** function as an intermittent switch. Current flows only when both switches are closed and returns by the ground through the engine or frame. The resistance of the primary winding of the ignition coil restricts the primary current flow.

The **Ignition Coil** consists of two windings, a primary winding and a secondary winding and is a transformer to increase the voltage high enough to jump a spark gap at a spark plug.

The **Condenser** momentarily provides a place for the current to flow until the distributor contacts are safely separated in order to reduce arcing.

The **Distributor** interrupts the primary winding current in the ignition coil and distributes the high tension current to the correct spark plug at the correct time.

The **Spark Plugs** provide a spark gap in the combustion chamber. The compressed air and fuel mixture is ignited when the high voltage jumps across this gap.

The **Low Tension Primary Wiring** conducts battery current through the ignition coil and contacts.

The **High Tension Secondary Wiring** conducts the high voltage, produced by the ignition coil, to the distributor and from the distributor to the spark plugs.

Operation — A primary current flows from the battery, through the ammeter and ignition switch to the coil primary winding, then to ground through the distributor contacts.

When the contacts open, the current tends to continue flowing across the contact gap. The condenser, which is connected across the contacts, momentarily absorbs this current and in doing so hastens the collapse of the magnetic field produced by the current in the coil primary winding.

This collapsing field induces a very high voltage in the secondary winding which is carried by the high tension wire to the center terminal of the distributor cap. The rotor connects this center terminal to one of the cap terminals which in turn is connected to the proper spark plug.

The spark produced by this high tension current ignites the fuel in that cylinder. This process is repeated for every power stroke of the engine and at high speeds, an impulse may be required as often as 300 times per second.

Ignition Coil — The function of the ignition coil is to transform the low voltage supplied by the battery into the high voltage to jump the spark plug gap.

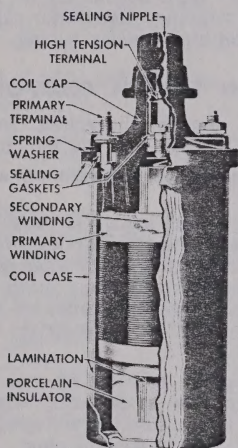


Figure 94 — Cutaway View of an ignition coil

An ignition coil has two windings wound on a soft iron core; the primary winding which consists of a comparatively few turns of heavy wire, and the secondary winding of many thousand turns of very fine wire. The primary winding is wound around the outside of the secondary winding. A soft iron shell encloses the outside of both windings and serves to complete the magnetic circuit.

Ignition coils do not normally require any service except keeping all terminals and connections clean and tight. The coil should be kept reasonably clean; however, it must not be subjected to steam cleaning or similar cleaning methods that may cause moisture to enter the coil.

Ignition coils can be tested for grounded windings by placing one test point on a clean part of the metal container and touching the other point to the primary and high voltage terminals. If tiny sparks appear at the points of contact, the windings are grounded.

If the coil is further suspected of being faulty, remove and check its operation on a coil tester and replace it if inoperative. Most coil testers compare the operation of the coil being tested with one known to be in good condition. This test should be made with the coils at room temperature and then

warming the coils five minutes by connecting the primary to a battery of the same voltage rating as the coils. Recheck the comparison test to see if the expansion due to heating has caused some defect to appear.

Distributor — The distributor conducts and interrupts the current through the primary winding of the ignition coil at the correct time and distributes the high tension voltage to the correct spark plug.

There are two separate electrical circuits in the distributor. The breaker contacts and condenser are in the primary circuit and carry low voltage current — while the cap and rotor are in the secondary circuit and carry the high voltage spark current.

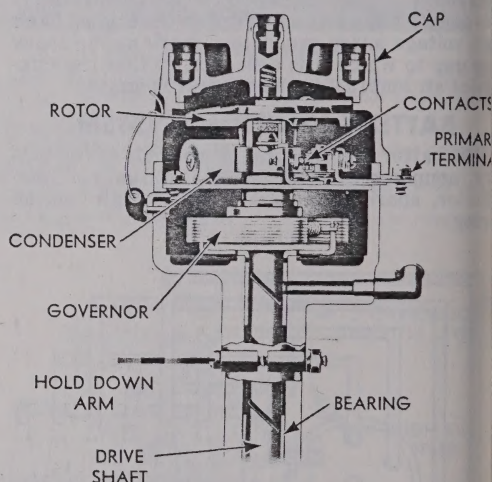


Figure 95 — Cutaway View of a distributor

The breaker contacts are mounted on a plate in the top part of the distributor housing. The grounded contact is stationary and the insulating contact is mounted on a breaker arm which is actuated by a cam near the top of the distributor shaft.

The rotor is mounted above the cam and turns with it to make a connection between the cap center contact and the various side contacts.

Continental L-Head engines have distributors equipped with a centrifugal governor which varies the timing by advancing the breaker cam as the engine speed increases. This mechanism consists of weighted levers which revolve with the distributor rotor and act against a set of springs. As the speed of rotation increases, the weights are moved out and the timing is advanced. With this arrangement it is possible to have a retarded spark for idling and obtain a gradual advance in spark timing as the engine speed is increased.

The **condenser** in the distributor prevents excessive arcing at the contacts. When the contacts first open, the current tends to continue flowing across the gap. The condenser absorbs this current until it becomes fully charged; but by this time, the contacts have opened far enough to prevent the current flow. If there were no condenser in the circuit, the current would continue to flow and cause an arc that would soon burn the contacts. The capacity of the condenser is designed to be large enough to prevent arcing and burning of the contacts and small enough to reduce the transfer of material from one contact to the other.

The **cam** is designed so that the breaker points remain closed for a certain number of degrees so as to give the coil a given length of time to build up or become energized. This is called the **cam angle**, as shown below:

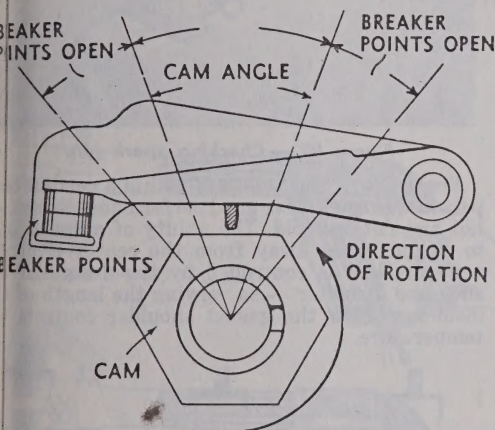


Figure 96 — Diagram illustrating cam angle

The cam is further designed to open the breaker points at a given speed in relation to cam travel to obtain proper point and condensor action. It is therefore important that the breaker points be adjusted to .020 gap so that proper cam angle is maintained.

DISTRIBUTOR MAINTENANCE — The distributor operation is vital to the operation of the engine and the following items should be carefully inspected every 250 hours of normal operation; however, dirt, dust, water and high speed operation may cause more rapid wear and necessitate more frequent inspections:

1 — Remove Distributor Cap — (without removing wires) — Clean cap and examine for cracks, carbon runners, corroded terminals or if the vertical faces of the inserts are burned — install a new cap.

If the horizontal faces of the inserts are burned — replace the cap and rotor as this is due to the rotor being too short.

2 — Check Centrifugal Advance Mechanism — for “freeness” by turning the breaker cam in the direction of rotation and then releasing it. The advance springs should return the cam to its original position.

3 — Inspect Breaker Points and Gap — if points are pitted, burned or worn to an unserviceable condition, install a new set of points. Badly pitted points may be caused by a defective or improper condenser capacity.

If the condenser capacity is too high, the crater (depression) will form in the positive contact; and, if condenser is too low, the crater will form in the negative contact as shown on the following sketch.

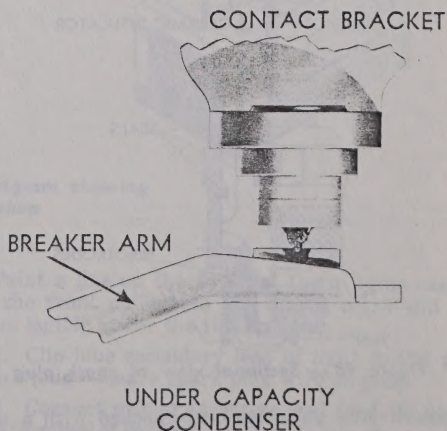
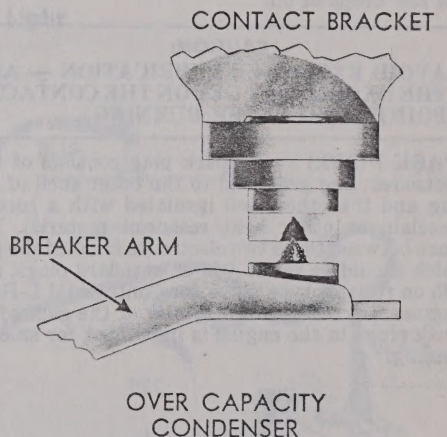


Figure 97 — Badly pitted breaker points caused by arcing due to incorrect condenser capacity

If the points are servicable, they should be dressed down with a fine-cut stone or point file. The file must be clean and sharp — never use emery cloth to clean contact points.

After filing, check the point gap and reset to .020 — the breaker arm must be resting on the high point of the cam during this operation.

When replacing points, make sure they are aligned and that they make full contact. Bend the stationary arm to obtain proper alignment — do not bend the breaker arm.

4 — **Lubrication** — is required at the shaft, advance mechanism, breaker cam and pivot. The shaft may be either oil or grease cup lubricated and should be given attention every oil change. Make sure the breaker arm moves freely on its hinge and apply a drop of light oil. A trace of ball bearing lubricant such as Mobilgrease Special (with Moly) should be used sparingly on the breaker cam unless lubricated by a felt wick with a few drops of oil.

CAUTION:

AVOID EXCESSIVE LUBRICATION — AS THE EXCESS MAY GET ON THE CONTACT POINTS AND CAUSE BURNING.

SPARK PLUGS — A spark plug consists of two electrodes; one grounded to the outer shell of the plug and the other well insulated with a core of porcelain or other heat resistant material. The space between these two electrodes is called the gap which should be set at .025 on standard plugs, and .035 on resistor type plugs for Continental L-Head Engines. Correct and uniformity of the gaps of all spark plugs in the engine is important for smooth running.

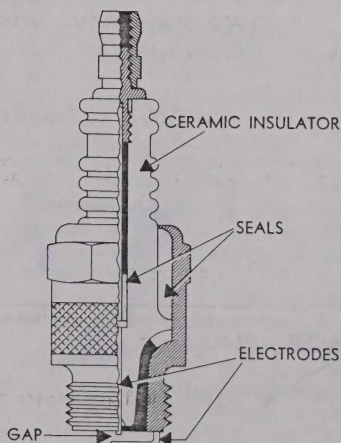


Figure 98 — Sectional view of spark plug

Spark plug gaps are best checked with a wire gauge unless the points are dressed to obtain a correct reading with a flat gauge. The adjustment should always be made on the side electrode and

never on the center electrode which may cause broken porcelain.

“Gapping” the electrode tip is more easily done with proper tools.

GAPPING THE SPARK PLUG. This illustration shows the use of the gapping tool which both measures and adjusts the electrode gap.

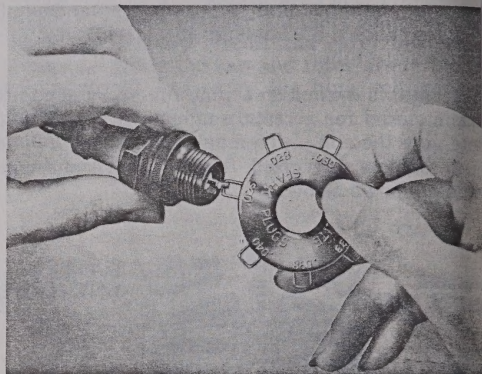


Figure 99 — Checking spark gap

Spark Plugs must operate within a certain temperature range to give good performance — not too hot and not too cold. The ability of a spark plug to conduct heat away from the center electrode and porcelain is controlled by the design of the shell and insulator — so varying the length of the insulator below the gasket shoulder controls the temperature.

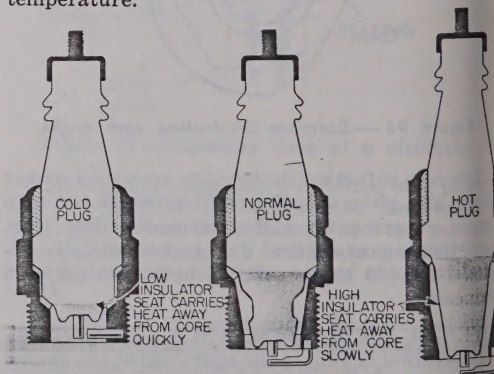


Figure 100 — Cold — Normal — Hot Spark Plugs

Cold-Normal-Hot Spark Plugs

Examination of a used spark plug will show if it is in the correct heat range for the operating conditions. If the plug runs too hot, the insulator will blister or crack and the electrodes burn away rapidly. If the plug remains too cool — soot and carbon will deposit on the insulator causing fouling and missing.

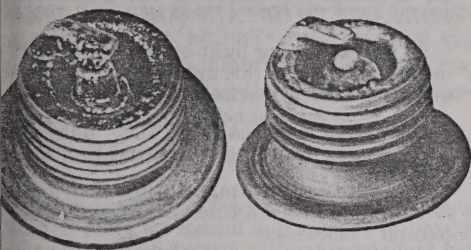


Figure 101 — Faulty spark plugs. Left: cold plug used in an engine that should have a hot plug. Right: hot plug used in an engine that should have a cold plug.

Spark plug electrodes will wear in the course of time and present day fuels have a tendency to form rusty-brown oxide deposits on the insulator tip. Therefore it is necessary to periodically clean the plugs with a plug cleaner and to reset the gaps to specifications.

Spark plugs must be correctly installed in order to obtain good performance from them. It is a simple but important matter to follow the following procedure when installing plugs:

1. Clean the spark plug seat in the cylinder head.
2. Use new seat gasket and screw plug in by hand.
3. Tighten all 18mm plugs to 35# torque with socket wrench of correct size.

DISTRIBUTOR — IGNITION TIMING With Timing Light

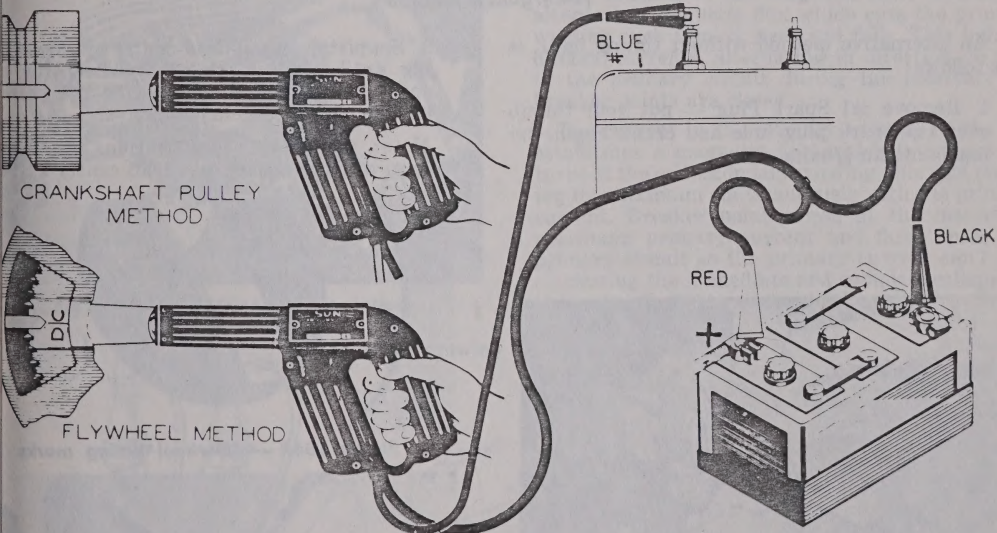


Figure 102 — Schematic diagram showing timing light hookup

Normally Continental L-Head engines with distributor-ignition are timed to have the distributor points start to open when #1 cylinder is on compression stroke and the flywheel mark "DC" (top-center) lines up with the pointer in the bell using.

There are two methods of checking ignition timing — with or without a timing light.

The preferred method is to use a timing light in following sequence:

Paint a line on the flywheel (or in some cases, on the front pulley) so the timing mark will be more legible under the timing light.

1. Clip blue secondary lead of light to the #1 spark plug — leave spark plug wire on plug.
2. Connect primary positive lead (red) to positive terminal of battery.
3. Connect primary negative lead (black) to negative battery terminal.

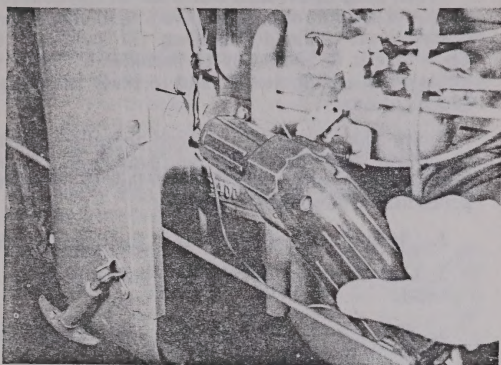


Figure 103 — Checking flywheel timing with timing light

4. Start engine and run at idle speed, 400 or lower, so the automatic advance of the distributor is completely retarded. **THIS IS VERY IMPORTANT TO OBTAIN CORRECT TIMING.**

5. Direct timing light on the crankshaft pulley or on the flywheel through opening in bell housing and note timing marks as light flashes.

6. Timing is normally at "D.C." unless specified otherwise on your engine specification sheet.

7. To advance timing, turn distributor clockwise. To retard timing, turn distributor counter-clockwise.

8. When timing is correct, tighten distributor clamp screw securely. Then recheck timing with light.

9. This operation is best performed in shaded area, so timing light is visible.

DISTRIBUTOR IGNITION TIMING Without Timing Light (Emergency Method)

An alternative method without timing light, is as follows:

1. Remove #1 Spark Plug — put your thumb over the spark plug hole and crank engine by hand until air is exhausting.

2. Set piston on top-dead-center by slowly cranking until "DC" mark on flywheel (or crankshaft pulley) will line up with the pointer on bell housing (or gear cover).

Note: Some special applications may be timed several degrees before top dead center (BTDC).

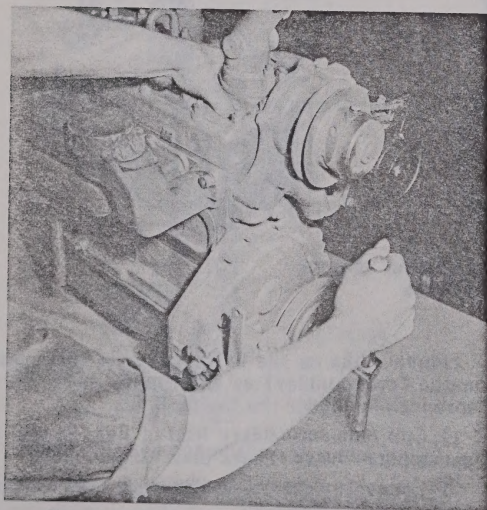


Figure 104 — Checking No. 1 Cylinder on Compression Stroke

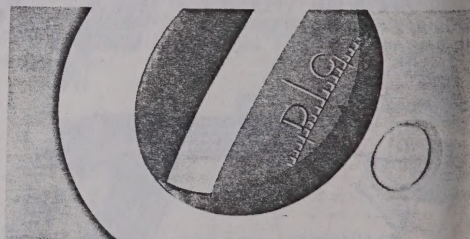


Figure 104A — Flywheel timing marks

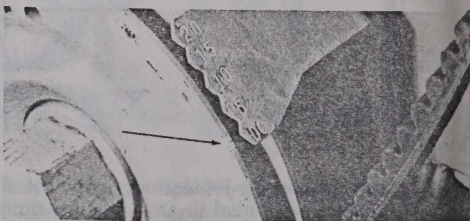


Figure 104B — Crank pulley timing mark

3. Loosen the distributor clamp bolt and rotate the distributor body until the contact points just **Start to Open**.

This may be more accurately checked by means of a test lamp connected between the distributor primary lead and the negative terminal of the battery — when the points are closed the light will go ON and as soon as the points break the light will go OFF.

4. Tighten distributor mounting bolts.

In high altitudes there is less tendency for sparking as well as low altitudes with premium gasolines. In such cases, improved performance may be obtained by advancing the spark **not to exceed** degrees ahead of specified setting.

CAUTION: WHEN ENGINE SPECIFICATIONS HAVE SPECIAL TIMING OTHER THAN TOP-DEAD-CENTER — THEY MUST BE FOLLOWED IN ORDER TO OBTAIN SATISFACTORY SERVICE IN SPECIAL APPLICATIONS OR HIGHER ALTITUDES.

MAGNETO - IGNITION

Magneto-Ignition is furnished on Continental L-Head engines on special applications to provide complete ignition system without requiring a battery. The smaller engines are easily hand-cranked that the starters and generators are not furnished in many of these applications.

The magneto comprises all the parts of the battery-ignition system with the exception of the

battery, and in addition, means for generating current impulses directly in the primary winding — which is in effect a spark coil.

The advantage of the magneto is this self-contained character. All the elements of the ignition system are in one compact unit, from which it only requires a low-tension cable to the ignition switch and high-tension cables to the spark plugs.

Operation

Magnetos are of the rotating magnet type with jump-spark distributor and are flange mounted to an accessory timing gear drive.

The rotation of the magnetic rotor sets up an alternating magnetic flux which cuts the primary winding each time it rises and falls. This induces electric currents, alternating in direction, to flow in the primary circuit during the intervals the breaker points are closed.

The current in the primary winding of the coil establishes a magnetic field which interlocks the turns of the coil secondary winding, this field reaching its maximum simultaneously with the primary current. Breaker point action at the instant of maximum primary current and field, opens the primary circuit so the primary current can't flow — causing the immediate and complete collapse of the magnetic field existing in the coil.

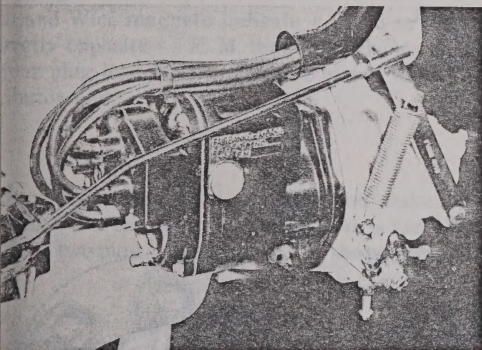


Figure 104C — Magneto installation

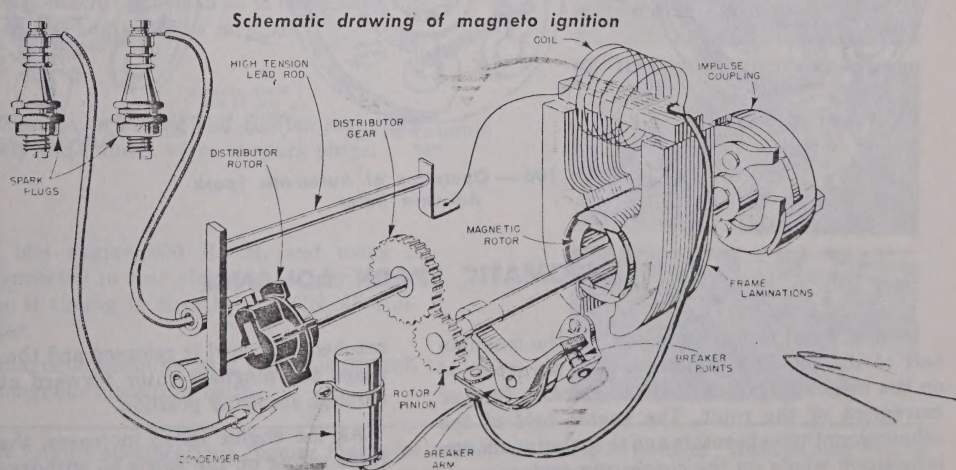


Figure 105

The ratio of turns in the coil secondary winding to those of the primary is very high so the induced voltage in the secondary winding is also very high.

The self-induced voltage occurring in the primary winding, as a result of the quick break of the

primary circuit, is absorbed by the condenser which is shunted across the breaker points. This action promotes a more rapid collapse of the primary field and at the same time reduces contact point burning caused by arcing.

IMPULSE COUPLING

All magnetos have an impulse coupling which assists starting by automatically retarding the ignition spark during the starting operation and at the same time producing an intense, hot spark — which would otherwise be impossible at very low engine speeds.

This device prevents the rotor of the magneto from turning during the starting operation until the engine piston is about at top-dead-center, at which instant the rotor is snapped forward at very high speed, producing an intense spark which is

automatically retarded to prevent back-firing. Since the point at which the release occurs can be controlled in the coupling construction — it is possible to provide an automatic retard of the ignition spark during the starting period.

Basically the impulse coupling consists of a shell and a hub, connected together by a strong spring. One half of the coupling (shell) is fitted with a drive member on the engine drive shaft — while the other half (hub) is keyed to the magneto rotor shaft.

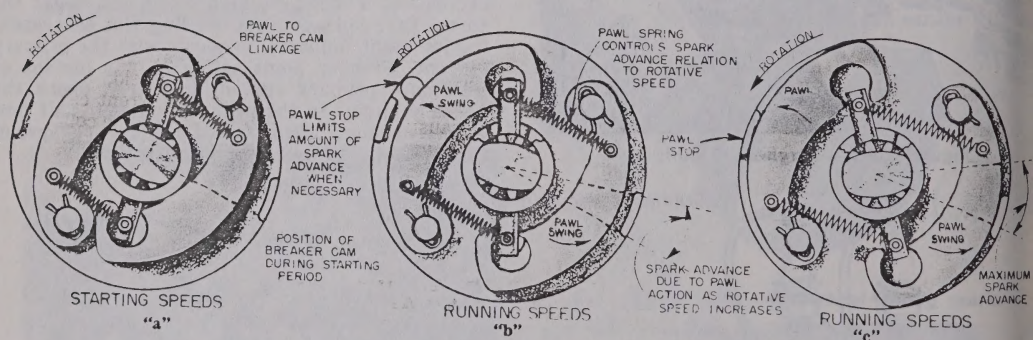


Figure 106 — Operation of Automatic Spark Advance Rotor

AUTOMATIC SPARK ADVANCE

In slow speed operation, a pawl on the magneto half of the coupling engages a stop pin mounted on the magneto frame — which prevents further movement of the rotor. The engine half of the coupling continues to rotate and the relative change in position winds up the connecting spring.

When the desired point of ignition spark is

reached, the pawl is released and the drive spring snaps the magneto rotor forward at high speed through its firing position.

As the engine speed increases, the centrifugal force acting on the pawls — withdraws them to a position not engaging the coupling stop pin — the impulse coupling then acts as a solid drive member

TIMING MAGNETO TO ENGINE

Remove rear spark plug (#4 on four cylinder and #6 on six cylinder engines.)

Set piston on top-dead-center by slowly cranking "DC" mark on flywheel (or crankshaft pulley) line up with the pointer in the flywheel housing (rear cover).

With magneto removed from the engine — put it in a vise lined with soft cloths and turn drive lugs of impulse coupling until lead to rear plug (#4 or #6).

On and Wico magneto indicate #1 lead so rear plug is directly opposite — F. M. magnetos are not marked, rear plug lead is at 5 o'clock position when facing distributor end.

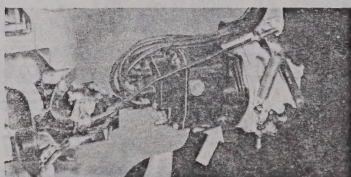
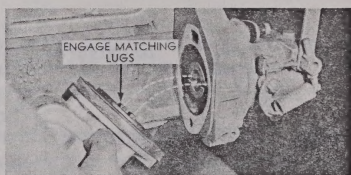
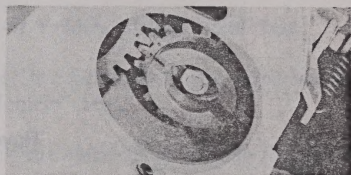
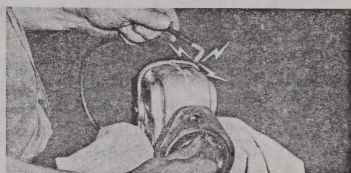
Check front end governor drive and make certain punch-marked tooth of timing gear is meshing between the two punch-marked teeth of the governor drive.

Turn back magneto drive lugs of impulse coupling counter-clockwise about $\frac{1}{4}$ turn so as to mesh with the timing slots of the engine drive member.

Position magneto on engine and tighten mounting bolts moderately and connect wires to spark plugs.

Start and idle engine 600 R.P.M. and using a timing light connected to rear plug and battery source check to see if timing is directly at "IGN-M" indicated by pointer.

If not, rotate magneto assembly until timing is correct, then tighten magneto mounting bolts.



IMPORTANT: Engine specifications require magnetos with the correct amount of "Built-in Lag" — which permits timing the magneto to the engine correctly as outlined.

Do not substitute other magnetos.

CHARGING CIRCUIT

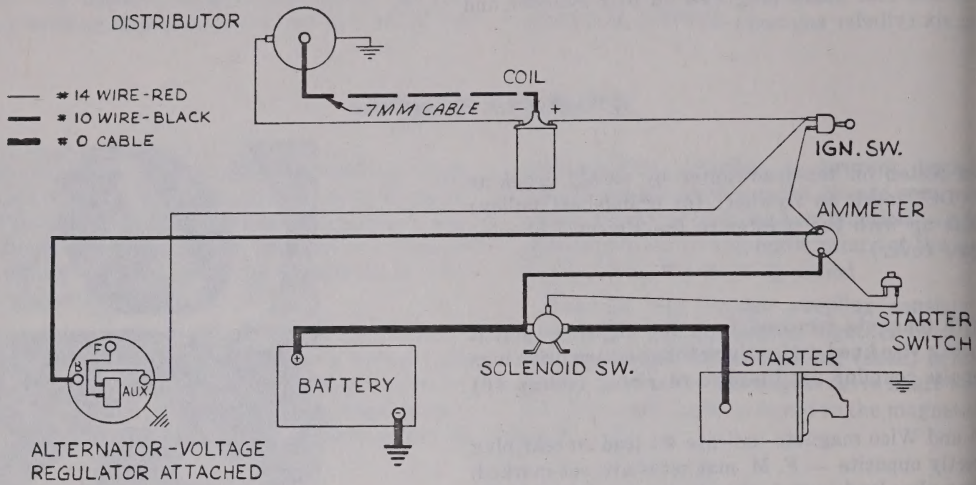


Figure 108 — Wiring Diagram (Prestolite)

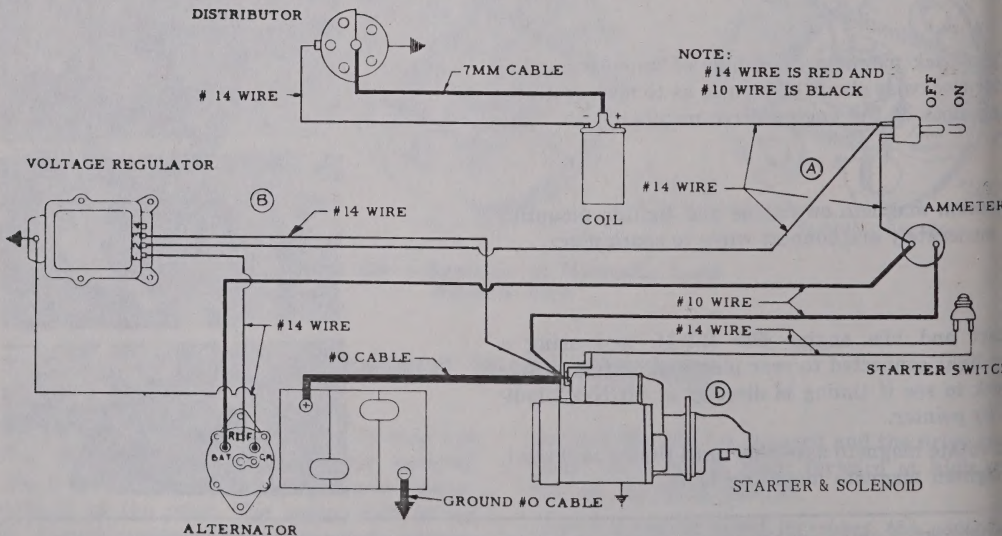


Figure 109 — Wiring Diagram (Delco)

The charging circuit consists primarily of a generator, regulator, battery and wiring. When analyzing the charging circuit, the components should be checked in the following order:

Wiring

Wiring in the charging circuit should be carefully inspected for frayed insulation or other damage, and replace any wiring that is defective. Also inspect all connections to the generator, regulator and battery (including all ground connections), and clean and tighten as required.

Battery

The lead-acid storage battery, used on automotive and industrial applications, is an electrochemical device for converting chemical energy into electrical energy.

It has three major functions:

1. It provides a source of current for starting the engine.
2. It acts as a stabilizer to the voltage in the electrical system.
3. It can, for a limited time, furnish current when the electrical demands of the unit exceed the output of the generator.

There are two types of batteries with which we are concerned: The DRY charged and the WET charged.

The DRY charged is shipped from the factory with charged plates, and the electrolyte is added when the battery is ready to be activated.

The WET charged battery is shipped from the factory with the electrolyte already added. This type must be recharged periodically, while in storage, to keep it ready for service.

Battery Testing

Visual Test — The battery should be inspected visually, checking the level of the electrolyte and the outside of the battery for damage and abuse.

The "In-Vehicle" Light Load Test

1. First, if the electrolyte level is low, adjust it to the proper level by adding water.
2. Then place a load in the battery by holding the starter switch "ON" for three seconds, or until the engine starts. If the engine starts, turn off ignition immediately. This removes the surface charge.
3. Then, turn the headlights on low-beam. The headlights must be turned on for one minute before starting the light load test and then left on during the test.
4. If any cell reads 1.95 volts or more and the difference between the highest and lowest is less than .05 volt, the battery is good.

The "Out-of-Vehicle" Light Load Test

This test is conducted in the same way as the "In-Vehicle" test.

To check the electrical condition of battery cells:

1. Place a 150 ampere load on battery for three seconds, using a high rate load tester, to remove surface charge.
2. Then, place a ten ampere load on battery for one minute before starting the Light Load Test. The difference in voltage readings between the individual cells can be interpreted in the same way as indicated under the "In-Vehicle" Light Load Test.

Specific Gravity Cell Comparison Test

This test should be used only on batteries having one-piece cell covers. Measure the specific gravity of each cell, regardless of state of charge, and interpret results as follows:

If the maximum difference between cell readings is less than .050 (50 points) and the lowest cell reading is 1.200 or above, the battery is good.

Full Charge Hydrometer Test

This test is given to fully charged batteries. If cell readings range between 1.230 and 1.310 specific gravity, the battery is ready for use.

NOTE: Add 4 points (.004) to the reading for every 10°F electrolyte temperature above 80°F, and subtract four (4) points for every 10°F electrolyte temperature below 80°F.

Selecting A Replacement Battery

When selecting a replacement battery it should be noted that battery power shrinks while the need for engine cranking power increases with falling temperatures. (See Chart)

BATTERY POWER	TEMPERATURE	ENGINE CRANKING POWER NEEDED
100 %	80°	100 %
68 %	32°	165 %
46 %	0°	250 %
30 %	-20°	350 %

Installing Batteries

The following points are important to properly install a battery:

1. Be sure the battery carrier is clean and that the new battery rests level when installed.
2. Tighten the hold-down evenly until snug. Do not draw down tight enough to distort or crack battery case.
3. Be sure the cables are in good condition and the terminal clamps are clean. Grease battery terminals lightly before attaching cable clamps. Make sure the ground cable is clean and tight at engine block or frame.
4. Check polarity to be sure battery is not reversed with respect to the generating system.
5. Connect "grounded" terminal of the battery last to avoid short circuits which will damage the battery.

Servicing Batteries

The following points are important to properly service a battery:

1. Check the level of the electrolyte regularly. Add water if necessary but do not overfill.
2. Keep the top of the battery clean. When necessary, wash with baking soda solution and rinse with clear water. Do not allow soda solution to enter cells.
3. Inspect cables, clamps and hold down bracket regularly. Replace if necessary.
4. Use the light load test as your regular service test to check battery condition.
5. Check the electrical system if the battery becomes discharged repeatedly.

CAUTION

Sparks or Flames Near a Battery that is Being Charged May Ignite Explosive Gases Causing a Dangerous Explosion

III. Alternator

The alternator differs from the conventional D.C. shunt generator in that the armature is the stationary member and is called the stator; while the field is the rotating member and is called the rotor. Alternating current is rectified (changed to direct current) by means of diode rectifiers rather than mechanically with brushes coming into contact with the various segments of the rotating armature on the generator. With this construction, the higher current values involved in the armature or stator may be conducted to the external circuit through fixed leads and connections rather than through the rotating commutator and brushes as in D.C. generator. The comparatively small values of current supplied to the field may be conducted without difficulty through small brushes and rotating slip rings.

The alternator is somewhat lighter and more compact in design than the conventional D.C. generator of comparable electrical size and is equally as simple to service and test.

Each bearing is prelubricated which eliminates the need for periodic lubrication.

PRECAUTIONS TO BE OBSERVED WHEN TESTING OR SERVICING THE ALTERNATOR SYSTEM.

1. DISCONNECT THE BATTERY, before connecting or disconnecting test instruments (except voltmeter) or before removing or replacing any unit or wiring. Accidental grounding or shorting at the regulator, alternator, ammeter or accessories, will cause severe damage to the units and/or wiring.
2. TO AVOID DAMAGE TO THE REGULATOR, DO NOT, AT ANY TIME, CONNECT BATTERY TO THE REGULATOR FIELD TERMINAL.
3. THE FIELD CIRCUIT MUST NEVER BE GROUNDED, ON THIS SYSTEM, BETWEEN THE ALTERNATOR AND THE REGULATOR. Grounding of the field terminal either at the alternator or regulator will damage the regulator.
4. IF IT IS NECESSARY TO SOLDER ANY LEAD TO A RECTIFIER LEAD, use a pair of pliers as a heat dam between the solder joint and the rectifier.
5. THE ALTERNATOR MUST NOT BE OPERATED ON OPEN CIRCUIT WITH THE ROTOR WINDING ENERGIZED.
6. DO NOT ATTEMPT TO POLARIZE THE ALTERNATOR. No polarization is required. Any attempt to do so may result in damage to the alternator, regulator, or circuits.
7. GROUNDING OF THE ALTERNATOR OUTPUT TERMINAL MAY DAMAGE THE ALTERNATOR AND/OR CIRCUIT AND COMPONENTS.
8. REVERSED BATTERY CONNECTIONS MAY DAMAGE THE RECTIFIERS, WIRING OR OTHER COMPONENTS OF THE CHARGING SYSTEM. Battery polarity should be checked with a voltmeter before connecting the battery.
9. IF A BOOSTER BATTERY OR FAST CHARGER IS USED, ITS POLARITY MUST BE CONNECTED CORRECTLY TO PREVENT DAMAGE TO THE ELECTRICAL SYSTEM COMPONENTS. (POSITIVE TO POSITIVE, NEGATIVE TO NEGATIVE).

IV. Regulator

Some regulators are fully transistorized and completely sealed. These can not be adjusted or repaired, and it can be assumed that this type regulator will outlive the other components in the charging system.

Other regulators are adjusted and repaired in accordance with the manufacturer's instructions.

Installation of Regulator for Alternator

To insure proper operation and to protect the alternator and regulator, the following steps should be observed during installation.

1. Make sure regulator is of the same voltage and polarity as the alternator and battery.
2. Disconnect battery cable at battery terminal.
3. Make sure the mounting area of the alternator and regulator base are clean and make a good tight connection.
4. Connect alternator in accordance with the manufacturer's instructions.
5. Do not flash field or ground terminals of the regulator.
6. Reconnect battery cable.
7. Start engine and observe ammeter. A "High" charge rate is normal for the first few minutes, but will decrease as the regulator warms up.

NOTE: When servicing the charging system, never remove a unit until tests have shown it to be defective. Reference always should be made to the manufacturer's maintenance manuals for a complete trouble shooting story.

SECTION VIII ENGINE REPAIR AND OVERHAUL

This section includes instructions for repairs and overhaul of the component units of Continental Red Seal L-Head engines.

Provide a clean place to work and clean the engine exterior before you start disassembling — dirt causes engine failures. Many shop tools have been developed to save time and assure good workmanship; these should be included in your equipment.

Use only genuine Red Seal parts in Continental engines since years of development and testing have gone into these specifications to assure maximum life and performance.

CYLINDER HEAD

The cylinder head is an important part of the engine assembly since it contains the complete combustion chamber and cored passage for water flow. Remove the cylinder head in the following sequence:

1. Drain water from engine and disconnect radiator or heat exchanger outlet hose.
2. Loosen and remove the nuts holding the cylinder head to the block.
3. Lift the cylinder head off the engine and carry to a clean bench for further disassembly.
4. Remove all carbon from combustion areas using a scraper and wire brush.

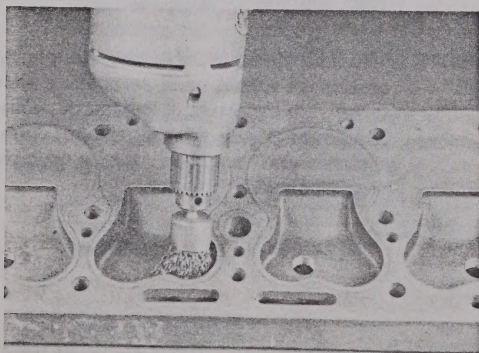


Figure 110 — Cleaning carbon from combustion chamber

5. Clean the cylinder head thoroughly with solvent or degreasing solution and blow it with air pressure.

6. Make sure that gasket contact surfaces the head and block are clean, smooth and flat.

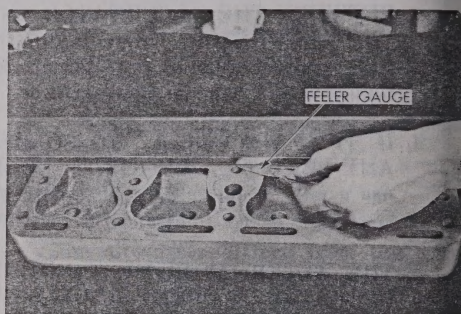


Figure 111 — Checking cylinder head flatness lengthwise.

7. Check out-of-flatness with straight edge and feeler gauge: maximum permissible is .000 inches per inch of width or length. Thus, for cylinder head 16" long, maximum permissible lengthwise out-of-flatness is .012". Out-of-flatness should vary gradually and uniformly from end to end and side to side. Localized depressions or high spots should not exceed .003.

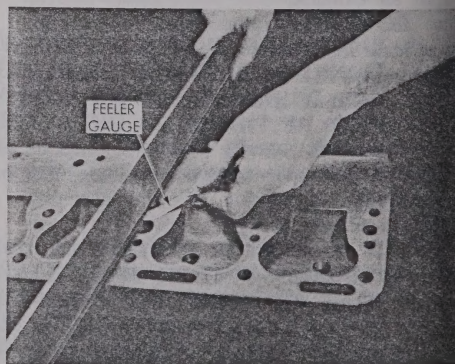


Figure 112 — Checking cylinder head flatness crosswise.

CYLINDER BLOCK

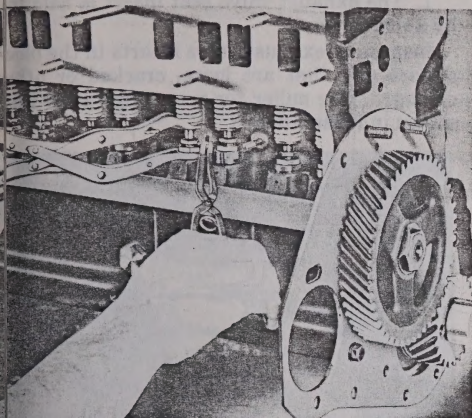


Figure 113 — Valve Removal

With a valve spring lifter, compress the springs and remove the locks or pins from the valve stems which are in a closed position. Close the valves by rotating the crankshaft and remove the locks (or pins) from these valves in the same manner. Remove all valves and place in order in a rack, with holes numbered for both intake and exhaust valves so they will not be mixed in packing.

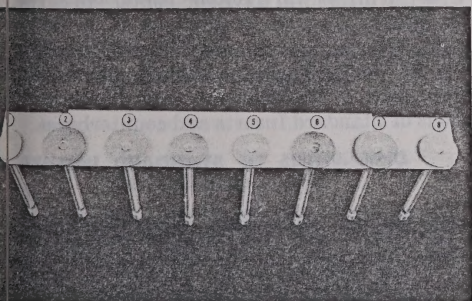


Figure 114 — Valves in rack

VALVE GUIDES

1. Clean the valve stem guides, removing lacquer or other deposits by running a valve guide cleaner or wire brush through the guides.
2. Check guides for wear by using "Go and No-Go" plug gage or a telescope gage and 1" micrometer. Replace all guides that are worn bell-mouthed and have increased .0015 in diameter. See Limits and Clearance Section for maximum diameter permissible to determine actual amount the diameter has increased. Remove all valve guides when necessary by using an arbor press and pressing them out from the combustion chamber side with a driver slightly smaller than the O.D. of the valve guide.

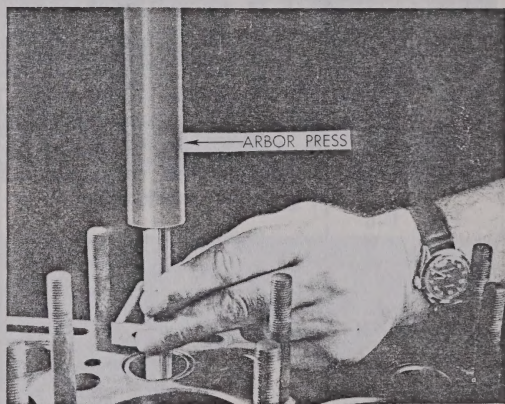
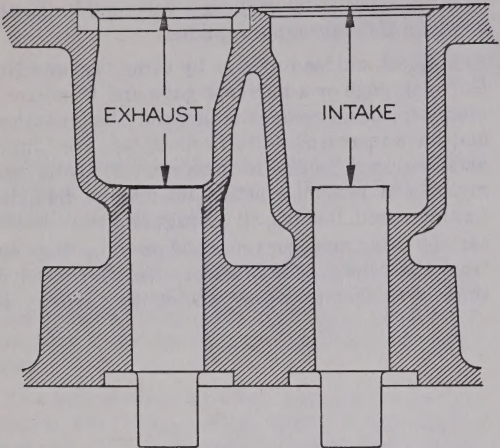


Figure 115 — Removing valve guides

3. Replace worn guides as required by using a suitable driver and an arbor press from the combustion side to the correct depth below the valve seat as given in the Limits and Clearance Chart.



Engine	Distance from Block Face to Top of Guide	
	Intake	Exhaust
N56, N62	$25\frac{5}{32}$	$25\frac{5}{32}$
Y69, Y91, Y112	$7\frac{7}{8}$	$7\frac{7}{8}$
F-4, F-6 Series	$11\frac{1}{2}$	$11\frac{1}{2}$
M271, M290 M330, M363	$11\frac{1}{4}$	$19\frac{1}{16}$
B371, B427	$17\frac{7}{8}$	$15\frac{1}{16}$

Figure 116 — Diagram and chart showing valve guide location

CAUTION: When replacing guides that are ferrox coated do not ream since these are all pre-reamed before being ferrox coated — any further reaming will remove the coating.

VALVE SEAT INSERTS

1. The exhaust valve seat insert is held in by a shrink fit.
Inspect all exhaust valve inserts in the block replace any that are loose, cracked or other damaged. Use puller for removing faulty insert shown in illustration.

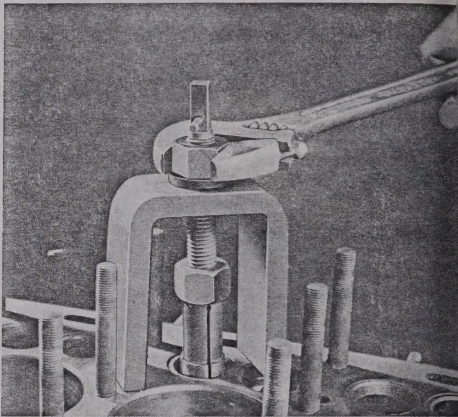


Figure 117 — Removing exhaust valve seat insert

2. When required to replace with new insert clean and counterbore for .010 larger insert with counterbore tool with correct fitting pilot.
When machining the counterbore, be sure to go deep enough with the tool to clean up the bottom that the insert will have full contact to carry a heat.
Continental does not recommend installing inserts having the same outside diameter as one removed. The following chart shows the dimensions of Standard Inserts and counterbores:

DIMENSIONS OF STANDARD INSERTS AND COUNTERBORES

Engine Model	Outside Dia. of Insert (A)	Inside Dia. of Counterbore (B)	Press
N-56 N-62	1.068-1.067	1.063-1.062	.004-.003
Y-69 Y-91 Y-112	1.1295-1.1285	1.1255-1.1245	.003-.002
F124 F135 F140 F163 F244 F245 F162	1.3485-1.3475	1.3445-1.3435	.003-.002
F-186 F-209 F-226 F-227	1.442-1.441	1.438-1.437	.003-.002
M-271 M-290 M-330 M-363	1.692-1.691	1.688-1.687	.003-.002
B-371 B-427	1.8785-1.8775	1.8755-1.8745	.003-.002

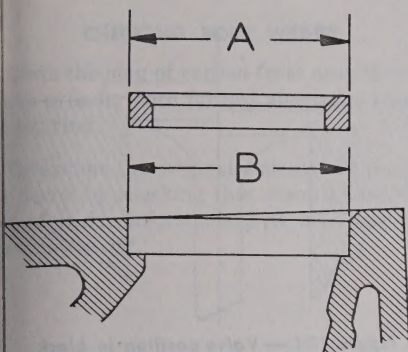


Figure 117-A — Insert and counterbore

When OVERSIZE inserts are used, dimensions of the insert and counterbore increase proportionally (.010, .020 — depending on the oversize).

New insert installation should have a press fit. Insert in container with dry ice for 20 minutes before assembling.

Insert may then be installed in the counterbore with a piloted driver, tapping in place with very light hammer blows, without the possibility of cracking the side walls. This assures it being seated properly on the bottom of the counterbore.

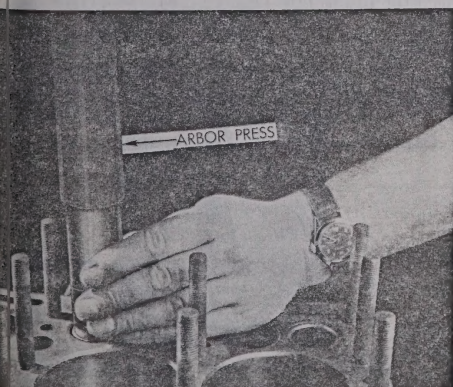


Figure 118 — Installing valve seat insert with an arbor press

3. Grind the intake and exhaust valve seats in the block in accordance with instructions in the limits and clearance chart and before removing the arbor, indicate the seat. Total indicator reading of the run-out must not be more than .002". Use a pilot having a solid stem with a long taper, as all valve seats must be ground concentric and square with either new or worn valve stem guide holes.

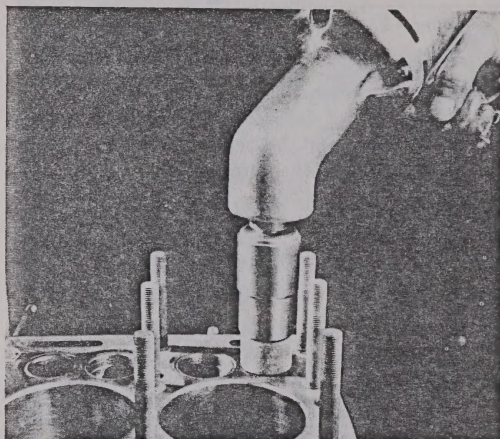


Figure 119 — Grinding Valve Seat

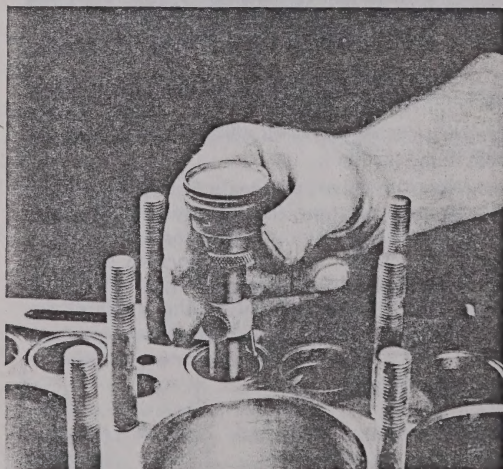


Figure 120 — Indicating Valve Seat

VALVES

1. Inspect valves for condition and replace any that are "necked", cracked or burned, also any on which valve stems are bent or worn more than .002 over the maximum allowable limits. Reface or replace all valves.

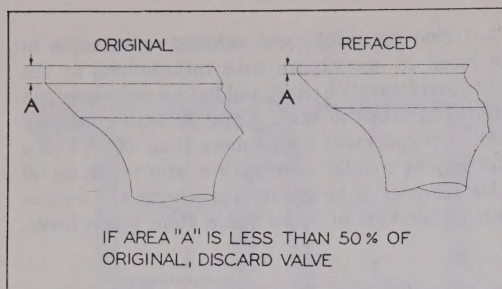


Figure 121 — Allowable head thickness of refaced valves

2. All valves having less than 50% margin thickness (outer edge of valve head) after refacing has been completed must be replaced. To check this dimension, compare the refaced valve with a new valve.

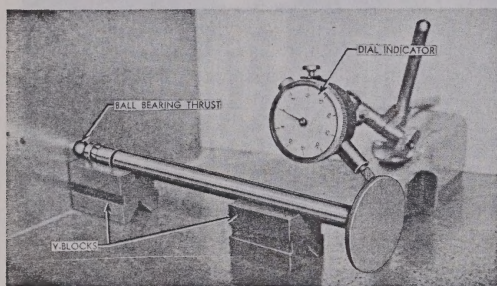


Figure 122 — Checking valve face in "V" blocks

3. Check all refaced or new valves in V-blocks with indicator to determine if the contact face is true with the stem within .002. If not, repeat the refacing operation.

4. After the valves and seats have been refaced and reground, coat the seat lightly with Prussian blue and drop the valve into position, oscillating it slightly to transfer the blue pattern to the valve face. This should show a contact width of $\frac{1}{16}$ " to $\frac{3}{32}$ " and should fall well within the width of the valve face, leaving at least $\frac{1}{64}$ " on either side where

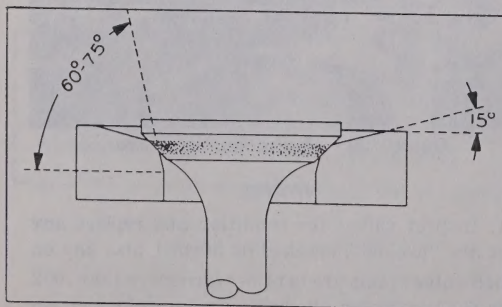


Figure 123 — Method of narrowing valve seats

the blue does not show. If the contact is over $\frac{3}{32}$ " wide, the seat in the head may be narrowed using a 15° stone to reduce the outside diameter using a 60° or 75° stone to increase the inside diameter.

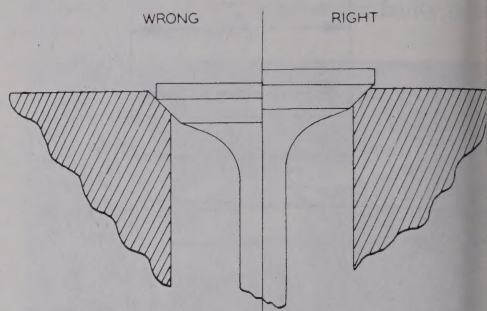


Figure 124 — Valve position in block

Never allow valves to set down inside the seat.

After the narrowed-down seat is brought within specifications, the seat should be retouched lightly with the original stone to remove burrs or feathered edge.

"A poor valve grinding job cannot be corrected by valve lapping."

5. Coat the valve stem with a light film of engine oil.

VALVE SPRINGS

1. Check all valve springs on a spring tester make sure they meet specifications regarding weight and length. Springs, when compressed the "valve open" or "valve closed" length, must fall within the specifications shown on the chart when new, and must not show more than 10% loss in re-use.

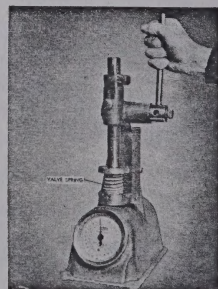


Figure 125 — Valve spring tester

2. Reassemble the valves and springs in the block with the retainers and retainer lock.

CHECKING BORE WEAR

Clean the ring of carbon from around the top of the cylinder bore formed above the travel of the top ring.

Determine the original diameter of the cylinder barrel by checking this unworn area with a pair of inside micrometers at intervals of approximately 45°.

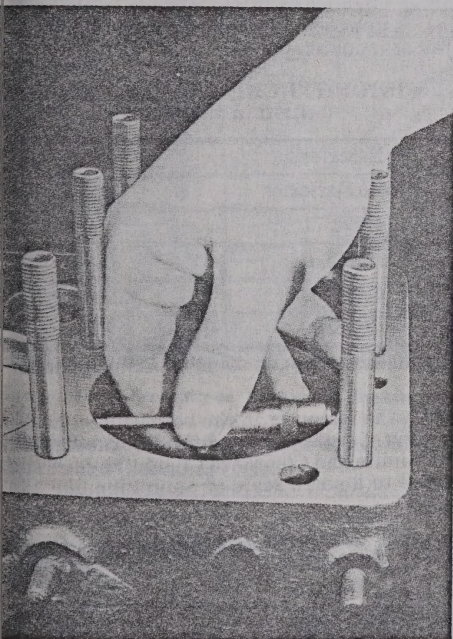


Figure 126 — Measuring original bore diameter above ring travel

Check in same manner the top of the ring travel area approximately $\frac{1}{4}$ " below the shoulder.

The maximum difference in the above checks, indicates the amount of cylinder bore wear. If less than .008, re-ringing will be suitable and if over .008 re-boring is recommended.

PREPARING CYLINDER WALLS FOR RE-RINGING OR REBORING

1. Ridge ream the cylinders to remove the unworn area at the top so that the new rings when assembled will not bump and distort both themselves and the piston lands.

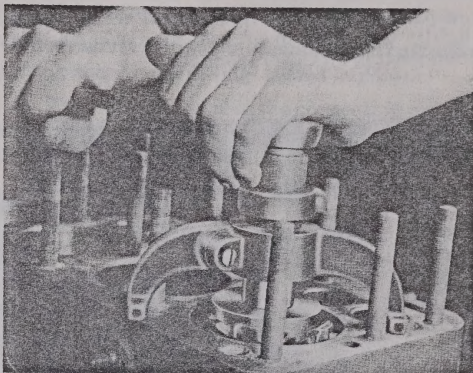


Figure 127 — Ridge reaming top of cylinder bore

Several good makes of ridge reamers are available which will ream the top of the bore in direct relation to the worn area so that should the worn area be off center slightly there will be no partial ridge remaining.

2. Drain the crankcase and remove the oil pan.
3. Remove the cap screws holding the connecting rod caps to the rod. *Keep the cap and bolts in numerical order so that when the pistons and rods are removed from the engine, the cap can be reassembled and kept with its mating part.*
4. Push the pistons and connecting rods up through the top of the cylinder, carrying with them all the carbon and metal chips left from the cleaning and ridge reaming operation. *When doing this, every precaution must be taken to prevent damage to cylinder bores by the sharp corners and rough edges of the connecting rods and bolts.*
5. To get the correct cross hatch pattern with a cylinder hone, use a top quality electric drill with a speed of 500 RPM or less.

It is important to remove the glaze on the cylinder bores by using a cylinder hone, with an adjustable stone tension, (see illustration), in order to assure quick seating of the new piston rings. **If the cylinder glaze is not removed, you will have no assurance as to when the rings will begin to function properly and control the oil; this is especially true when chrome rings are used.**

The following step by step procedure is recommended:

- a. Cover the entire crankshaft with a clean, slightly oily cloth to prevent abrasives and dirt from getting on the crankshaft.

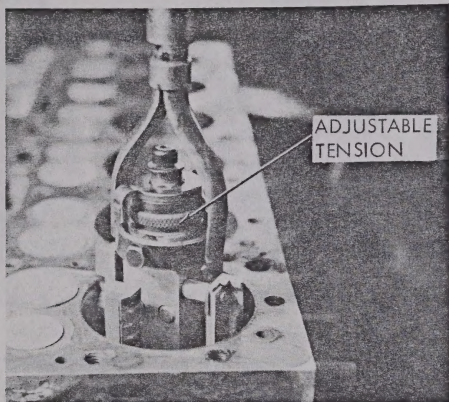


Figure 128 — Honing cylinders

- b. Remove the excess carbon deposits from the top of the cylinder wall before beginning the glaze breaking operation. (This is to prevent loading the stones.)

c. Insert hone in cylinder and expand to cylinder wall with slight tension. Using a clean brush, wet cylinder wall and stones with kerosene. Use a hand drill and surface hone cylinder with a rapid up and down motion to produce a good cross hatch pattern. Apply kerosene occasionally as needed and increase tension on hone adjustment until a good pattern and finish is obtained. A smooth finish of 10 to 15 micro inches is desired.

- d. Clean the loose abrasives from the stones by using kerosene and a wire brush.

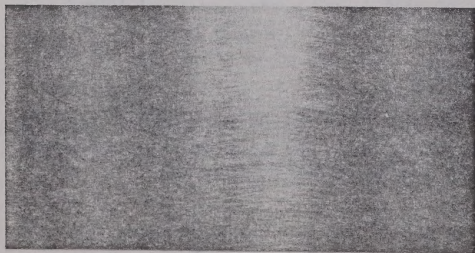


Figure 129 — Desirable cross hatch pattern obtained with a cylinder hone

IMPORTANT

Stones must be used wet. Keep applying kerosene during honing to prevent stones from drying out and causing an incorrect honing pattern.

e. The most desirable cylinder finish is 10-micro inches; with this finish the depressions in the surface tend to keep the supply of lubrication between the mating parts. This finish can be obtained by using 280 grit stones on the hone.

- f. Clean all bores thoroughly with a clean oil rag to pick up all the small particles of dust that may be embedded in the walls. Follow this with a clean cloth to make certain the walls are **CLEAN.**

PISTONS

Check the pistons for excessive ring groove wear, and replace any that exceed the allowable limits in our limits and clearance data.

The cylinder walls and pistons must be perfectly clean and dry when fitting pistons in the cylinder bores. Pistons should be fitted with the block and piston at room temperature (68° - 70° F).

PISTON FIT ON STANDARD PISTONS* (with 5 to 10# Pull)

N-Y Series	.002
F4, F6 Series	.003
M271	.004
M330	.005
M363	.003
B Series	.005

*This fit may vary on some special applications.

Check the piston fit in the bore using a half-inch wide strip of feeler stock, of the thickness specified in the Limits and Clearance Chart, the feeler being attached to a small scale of approximately 15 lb capacity.

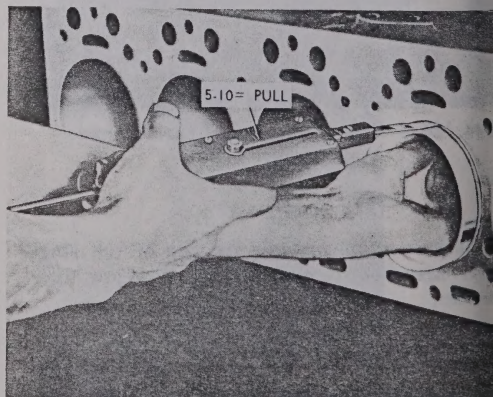


Figure 130 — Checking Piston fit in bore

When the correct fit is obtained you must be able to withdraw the feeler with a pull of 5-10 pounds on the scale, with the feeler inserted between the piston and the cylinder midway between the piston bosses where the diameter of the piston is the greatest. Check the fit of the piston when it is approximately 2" down in the cylinder bore in an inverted position.

PISTON PINS

Check the bushing in the upper end of the connecting rod for wear. If worn and you are using the final pistons with a service set of rings, an over-piston pin may be obtained in .003 or .005" size.

The piston pin hole in the piston and the bushing in the connecting rod may be honed to increase

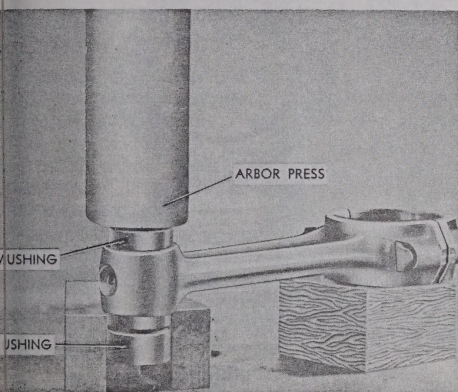


Figure 131 — Pressing in Piston Pin Bushing

diameter to obtain the desired fit as shown in Limits and Clearance Chart.

Note that while the chart specifies a light push fit of the pin in the piston, there is a definite clearance of the piston pin in the connecting rod.

CONNECTING ROD

Replace the bushing in the connecting rod if new pins and sleeves are used. Using an arbor press, remove the old bushing and press in the new one after which the bushing must be honed to obtain correct fit of the pin in the bushing as shown in Limits and Clearance Chart.

If there is an excess of stock in the piston pin bushing, it may be reamed first, then honed. In any case, the final operation should be done with a hone to obtain the desired fit with better than 75% honing area on the pin.

PISTON AND CONNECTING ROD ASSEMBLY

1. Assemble the pistons on the connecting rod by first heating them in some form of oven or in hot water to a minimum temperature of 160°F. When heated, the piston pin will enter the piston very easily and can be tapped through the connecting rod and into place without distorting the piston.

The snap rings must be assembled in the grooves, making sure they are fully seated in place.

2. The piston pin hole in the connecting rod must be parallel to and in plane with, the large bore in the bearing end of the connecting rod.

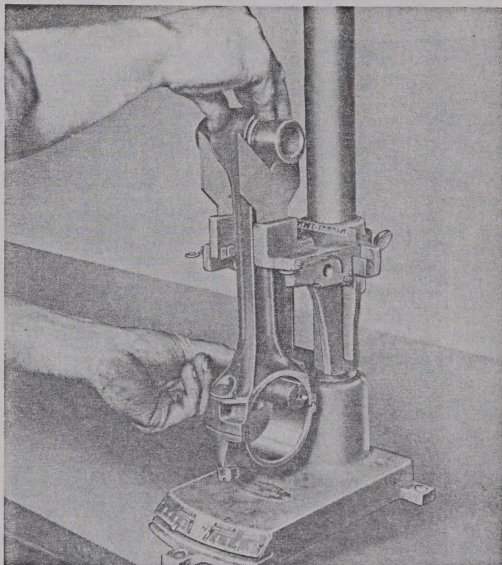


Figure 132 — Checking connecting rod for twist and alignment

This may be checked on a fixture with the piston pin assembled in the rod before assembling the piston; but regardless of this preliminary check, the completed piston and rod assembly must be rechecked and there must not be more than .002" twist or out of squareness checked over a spread of approximately 4 inches. The connecting rod can be bent or twisted to meet this specification.

PISTON RINGS

Check the piston rings in the cylinders for

To do this, insert a piston in the cylinder in an inverted position and then insert each one at a time about 2" down in the bore and bring the bottom edge of the piston up against the cylinder wall to square it up in the cylinder bore.

Check the gap between the ends of the rings with a feeler gauge in accordance with specifications shown in the Limits and Clearance chart.

RECOMMENDED METHOD OF INSTALLING PISTON RINGS

1. Grip the connecting rod in a vise with lined jaws to hold the piston firmly and roll the straight side rings in its groove to be sure there are no burrs or other interference with free action of the ring in the groove.

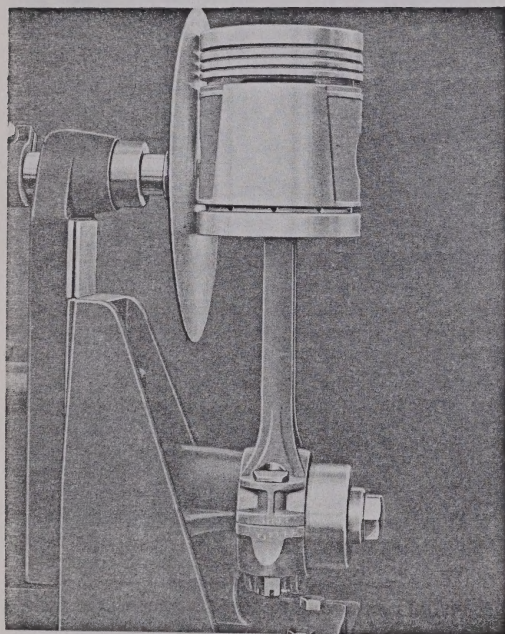


Figure 134 — Checking connecting rod assembly for alignment

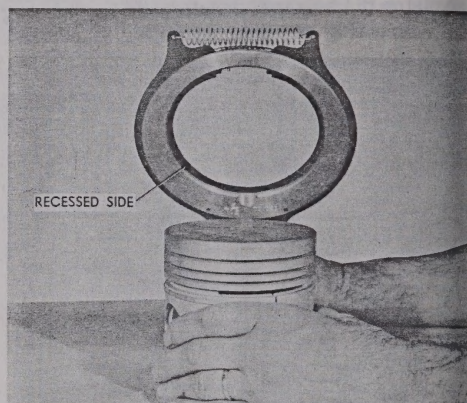


Figure 135 — Installing rings with ring expander tool

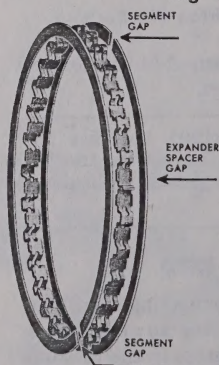


Figure 136 — Three piece oil ring

- Place stainless steel expander spacer in groove with ends butted.
- Install steel segment on top side of expander spacer with gap between segments approximately 90° from the expander gap in opposite direction from which the top segment is still in a butted position.
- Install second segment on bottom side of the expander spacer with gap between segments approximately 90° from the expander gap in opposite direction from which the top segment has been installed.
- Recheck assembly — segments should be free to move in the groove, however, a slight drag should be evident because of the side loading action of the ring assembly. **SURE EXPANDER SPACER REMAINS IN BUTTED POSITION.**

e. When pistons are ready for installation in the cylinders, compress rings carefully using a ring compressor and a light tap on the head of the piston will force the assembly to go into the cylinder very easily. If any difficulty in tapping piston and ring assembly into the cylinder is encountered, the compressor should be removed and rings checked for correct installation in the groove.

PIN MILLED APPLICATION

Install gap of expander spacer 90° from pin, with hump of expander spacer over pin and ends butted. Install top segment, then bottom segment with gaps of segments over pin.

The 3 piece oil ring should be installed first on the piston, from the top side so skirt will not be scratched.

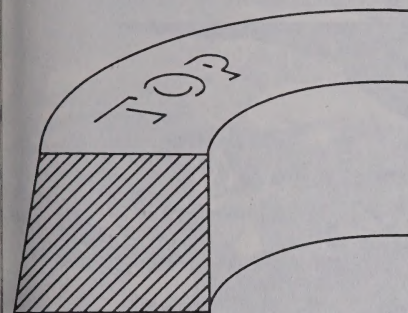


Figure 137 — Install Tapered Rings with "Top" Side Up

To install the balance of the rings, use a ring with recess side up and place the ring in the bottom side up. Start with the lowest first.

Some piston rings are taper faced. These are only marked "TOP" on the side to be up when installed on piston.

Position ring in the tool so the expanding rings will fully engage both ends.

Apply pressure on handles so ring is completely expanded. Pass the expanded ring and tool over side down over the piston to the proper position.

CAUTION

Piston is equipped with a steel groove insert, this must be installed on top of the number one ring. (The steel groove insert is not part of the re-ring kit — this can be re-used when changing rings.)

Check the ring side clearance at various positions with a feeler in accordance with the tolerances shown on the Limits and Clearance Chart.



Figure 138 — Checking Ring Clearance in Groove

CRANKSHAFT AND MAIN BEARINGS

1. Using a puller, remove pulley from crankshaft.
2. Take out screws and remove gear cover.
3. Drop the oil pump, by removing nut or cap screws holding pump to center main bearing cap.

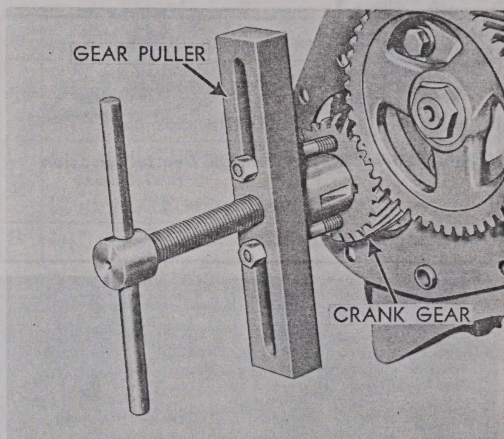


Figure 138A — Removing Crank Gear

4. Remove each main bearing cap, one at a time, and inspect the bearing and crankshaft journals.

If there is any indication of flaking out, scoring or actual wear, — they must be replaced.

BEARINGS

Some models use tri-metal bearings which when new are smooth and highly polished. However, a very few hours of operation will change their appearance completely. The bearing surface becomes a leaden gray in color and develops minute craters, almost cellular in appearance as indicated in the photograph, which follow the pattern of the matrix. This appearance is a natural characteristic of this type bearing and in no way indicates failure.

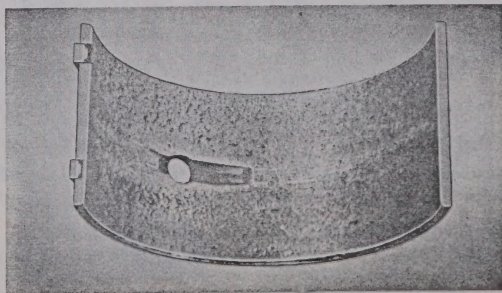


Figure 139 — Appearance of a Good Bearing

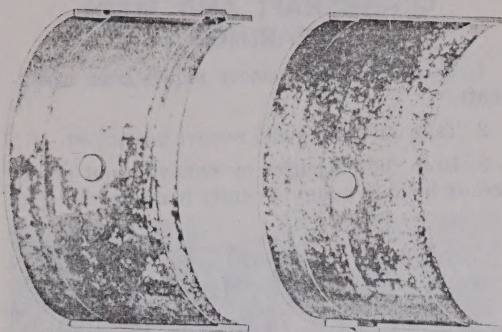


Figure 140 — Bearing Damage Due to Corrosion

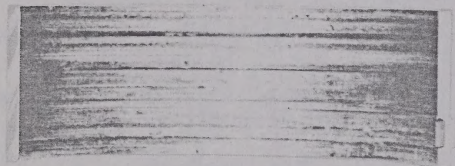
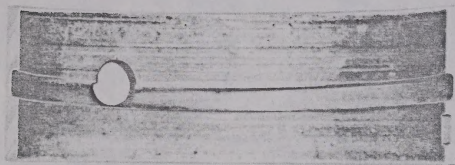


Figure 141 — Scored Bearing Due to Dirt or Lack of Oil

5. If the visual inspection appears satisfactory, they should be removed and checked for thickness using a ball micrometer.

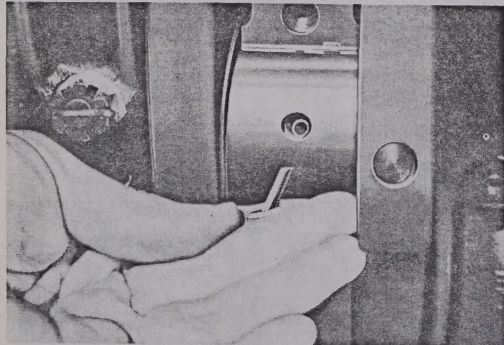


Figure 142 — Removing Main Bearing

To remove the upper half of the bearing shell, use a special tool obtainable at most parts houses which is a pin with an angular head. It may be inserted in the oil hole of the crankshaft and as the crankshaft is turned in a clockwise direction, the head of this pin picks up the bearing shell and forces it out of the bore in the block.

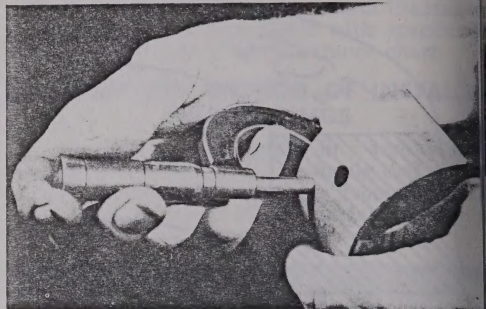


Figure 143 — Measuring Bearing Thickness

The thickness of the bearing shells is given in the Limits and Clearance Chart, and if this thickness has been reduced more than .0005 beyond the maximum allowable tolerance the bearing shell must be replaced.

6. If visual inspection of the crankshaft shows no indication of excessive wear or scoring, the clearance of the feeler should be checked.

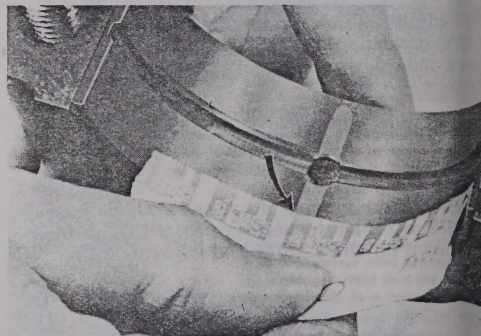


Figure 144 — Checking Bearing Clearance with Plastigage

7. Check each bearing, one at a time, by using a piece of Plastigage of a diameter specified in the chart to check certain clearances.

By placing this Plastigage in the bearing and tightening it in place, the width of the Plastigage after crushing determines the bearing clearance shown above.

CAUTION

When using this method DO NOT TURN the crankshaft as that would destroy the Plastigage.

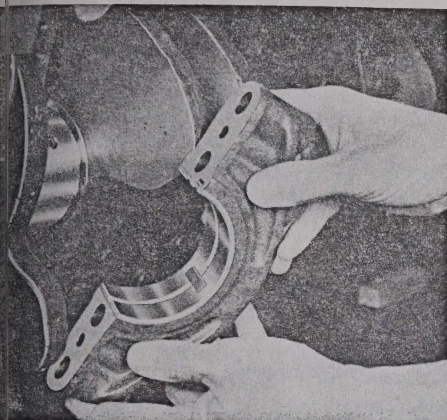


Figure 145 — Checking Bearing Clearance with Feeler Stock

alternative method is to use a piece of $\frac{1}{2}$ " stock (the thickness of which should be equivalent to the maximum clearance permissible in bearing) lengthwise, in the bearing shell, on top of oil. Assemble the bearing cap and tighten screws, torquing them to the specifications, — try to turn the crankshaft by hand to determine whether or not you can feel a drag.

If definite drag is felt and the piece of feeler stock is equivalent to, but no more in thickness than the maximum clearance specified, you may be sure that neither the crankshaft nor bearing are worn excessively as far as clearance is concerned.

When using new bearings and the crankshaft is worn, checking with a piece of feeler stock as described above should lock up the crankshaft, making it impossible to turn only by use of a bar or wrench.

If crankshaft is scored, or worn enough so that new bearings will not fit with the required clearance, it should be removed and reground.

Standard crankshafts may be reground to decrease the diameter a maximum of .040.

Before shaft is reground, it must be checked for straightness and straightened if necessary to be within .002 indicator reading. When reground, the fillet radii must be within dimensional limits and must be perfectly blended into thrust and bearing surfaces.

Connecting rod bearings and crank pins may be checked in the same manner with one exception; instead of trying to turn the crankshaft when the connecting rod bearing is tightened on it with a wrench, if feeler gauge assembled, try to move the connecting rod from side to side.

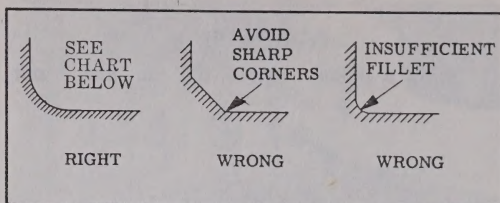


Figure 146 — Crankshaft Fillet Radii

N	$\frac{3}{32}$ " R on all crankpins and mains
Y	$\frac{5}{64}$ " R on all crankpins and front & center mains $\frac{3}{32}$ " R on rear main
F M	$\frac{3}{32}$ " $\pm$ $\frac{1}{64}$ " R on all crankpins and mains except rear $\frac{1}{8}$ " $\pm$ $\frac{1}{64}$ " R on rear main
B	$\frac{3}{32}$ " $\pm$ $\frac{1}{64}$ " R on all crankpins and mains

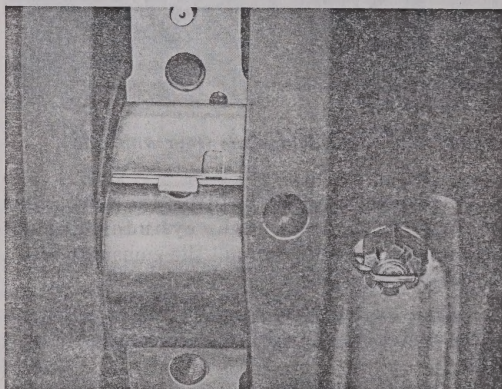


Figure 147 — Replacing Bearing

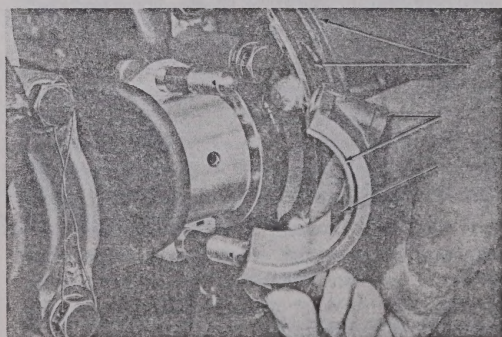


Figure 148 — Checking Rod Bearing with Feeler Stock

With new bearing shells and feeler stock equivalent to the specified clearance in thickness, if the crank pin is not worn you will quite probably have to use a hammer tap to move the rod from side to side, indicating that the clearance is well within the specification range.

CAMSHAFT

1. Using a puller, remove the cam and crank gears.

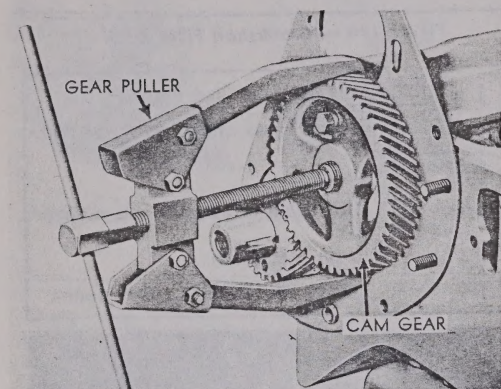


Figure 149 — Removing Cam Gear with Puller

2. Remove the screws holding the camshaft thrust plate to the front of the cylinder block, which makes it possible to pull the camshaft forward out of the bearings.

3. Unless engine is lying on its side, tappets must be removed or lifted before camshaft can be pulled.

4. Remove tappet chamber covers.

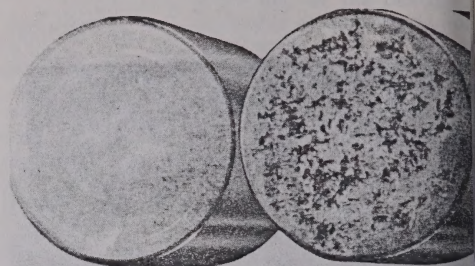
5. Tappets can then be lifted out and lined up in sequence, for installation in the same location unless inspection shows that they require replacement.

6. Before pulling the camshaft completely, check the clearance of the bearing journals in the bushing (or block in some models). To do this use strips of feeler stock $\frac{1}{4}$ " wide with edges dressed with a stone to eliminate any burrs or feathered edges.

7. If clearance is equal to or greater than the amount indicated under wear limits, check the diameter of the camshaft journals to determine the next step. Excess wear at these positions require replacement of the shaft.

If wear is found to be in the bushings instead, these must be replaced using precision service bushings, available for that purpose, which require no reaming, only care in assembly, to line up oil holes, and not to damage the bushings as they are being pressed in.

TAPPETS



ACCEPTABLE

NOT ACCEPTABLE

Figure 150 — Valve Tappet Wear Comparison

1. Inspect each tappet carefully. Two or more small pits on the contact face is acceptable; more than that calls for replacement of the tappet on the N, Y, F4, F6 Series.

Oversize tappets are available as required.

2. Check the outside diameter with microtens to determine if replacement is necessary cause of wear.

3. On the M and B series, tappet guides guide bushings may be checked for wear with plug gauge or preferably with a telescopic gauge and micrometer.

If guide bushings are used, they may be placed and std. tappets used. If bushings are used, the tappet bore may be reamed oversize, oversize tappets installed.

TAPPETS

ENGINE	O. D. TAPPET	BORE IN BLOCK	TOTAL MAX. WEAR LIMITS	
N, Y, F4, F6 Series	.9995 .9990	1.0008 1.0000	.005	Oversize tappets available

ENGINE	O.D. TAPPET	SLEEVE DIA.	TOTAL MAX. WEAR LIMITS	
M-B Series	1.1242 1.1237	1.1260 1.1250	.005	Std. sleeve and Std. Tappet available

Note: On the N, Y, F4, F6 engines, the tappet rides in a tappet bore in the block. On the M and B, guide bushings are used; dimension shown is the I.D. after bushing is installed in block.

CAUTION — WHEN INSTALLING CAMSHAFT USE SPECIAL CARE TO PREVENT CAMSHAFT BUMPING AND LOOSENING EXPANSION PLUG TO CAUSE AN OIL LEAK

TIMING GEARS

Timing gears and timing gear fits must be checked carefully while the engine is being overhauled. To check the fit, use a screw driver to force separating teeth as far apart as possible and check clearance with a feeler gauge. If this clearance is .02" or greater, or if the gear teeth are badly pitted and worn, the gear must be replaced. Timing gears must be replaced in pairs.

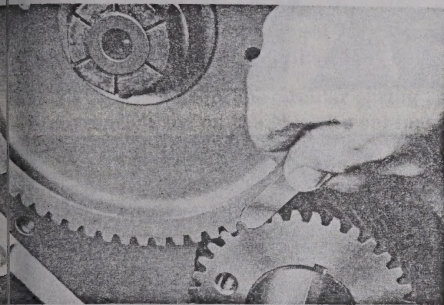


Figure 152 — Checking Timing Gear Backlash
Gears marked same as the original as far as they are concerned should be used as replacements.

Examine the camshaft thrust plate carefully for spring and wear and if any indication of either is shown, a new thrust plate should be assembled without question.

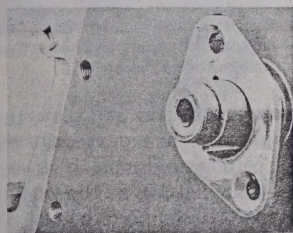


Figure 153 — Camshaft Thrust Plate

Assemble the cam gear to the camshaft by sliding or pressing it on, at the same time holding the camshaft forward with a suitable bar through the oil pump opening in the block so there is no possibility of the camshaft bumping the expansion plug at the rear end and forcing it out of position, thus causing an oil leak.

Check camshaft end play as shown in illustration. Refer to limits and clearance section for the correct dimension.

CAUTION: NEVER USE THE CAMSHAFT TO PULL THE GEAR ONTO THE CAMSHAFT. This will break the threaded end of cast iron camshafts and damage threads on steel camshafts.

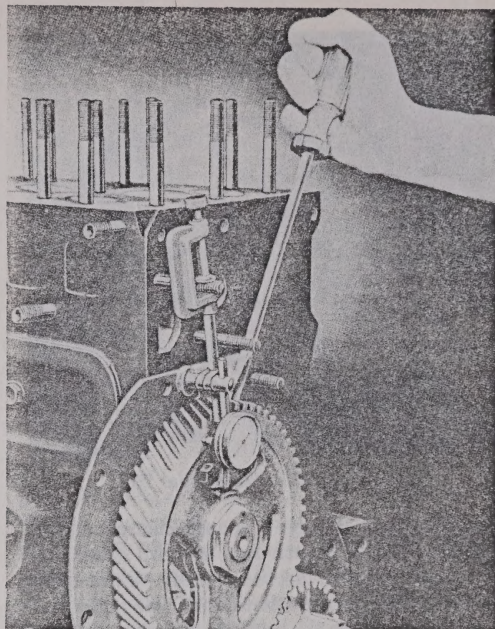


Figure 154 — Checking Camshaft End Play

4. Inspect crankshaft thrust washers for wear and scoring. Replace if necessary before reassembling gear.

5. Drive the crank gear on the shaft making sure that the marked teeth on the cam gear straddle the marked tooth on the crank gear, which assures you of the crankshaft and camshaft being in time.

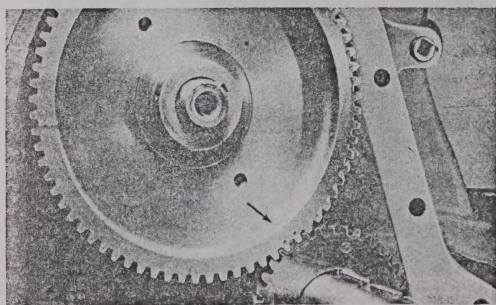


Figure 155 — Timing Gears Assembled According to Timing Marks

6. Check for clearance with the above gears assembled in place, since it may be possible that it is not within specifications. Repeat the operation previously outlined. Using a screwdriver pry the teeth as far apart as possible and check the clearance with a feeler gauge. If a .0015" feeler will not enter the gap the clearance is not excessive.

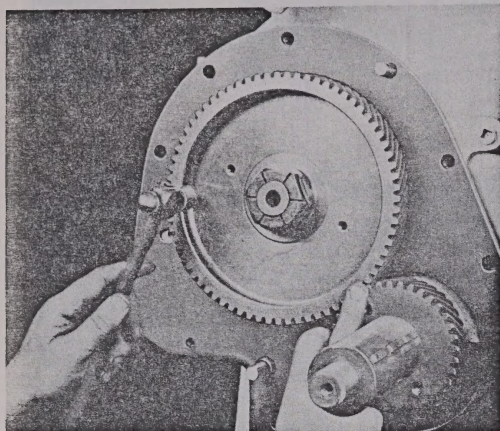


Figure 156 — Checking Gear Fit

To be certain that there is enough clearance, hold your finger at the junction of the two gears and with a light hammer tap the rim of the cam gear and note if there is vibration felt at this point.

If there is vibration and a .0015" feeler gauge will not enter the gap between the two gear teeth, the gear fit is within specifications.

7. Crankshaft gears and camshaft gears are furnished in standard and under and over sizes. Gears marked "S" are standard; if they are marked with figures "1" or "2" in a letter "U" this signifies undersize. If they are marked with figures in the letter "O" this signifies oversize.

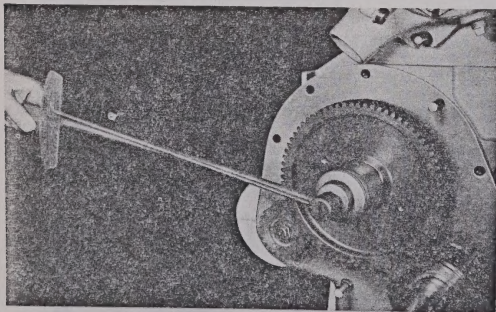


Figure 157 — Torquing Cam Gear Nut

CRANKSHAFT END PLAY

1. Check the crankshaft end play before replacing the gear cover. A shim pack containing shims of .002" and .008" thickness is incorporated in the assembly between the front end of the main bearing journal and the crank gear and by removing or adding shims, this end play can be corrected to fall within the specifications.

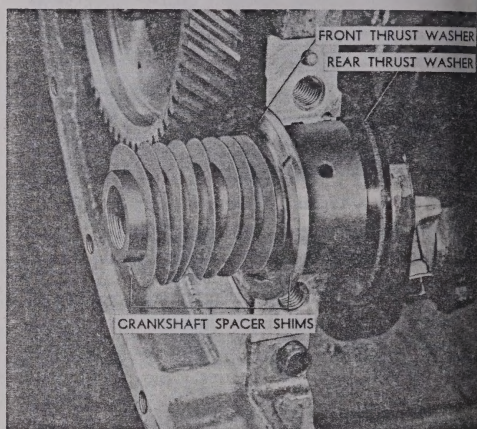
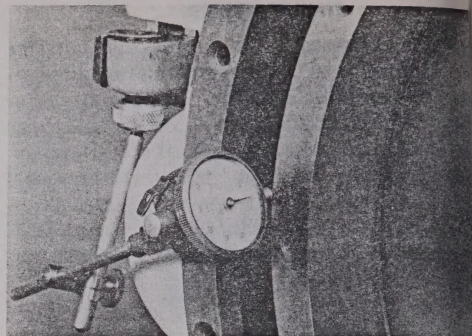


Figure 159 — Thrust Washers and Shims Controlling Crankshaft End Play

At all times when checking end play, the crank gear must be tightened firmly against the shim pack, which can be done by using a sleeve or the regular pulley, slipping it over the crankshaft and using the standard assembly parts to tighten the pulley and gear in place.

On F135 & F163 thrust is controlled by flange center bearings, which require no shims. On the F227 and F245 models, thrust is controlled by flanged brgs. located at the rear main. If end play exceeds .006 (using a feeler gauge) replace the flanged bearings. End play should be between the .002 and .006 limits.

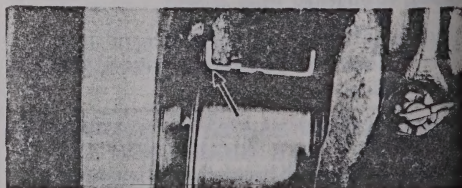


Figure 159A — Flanged Bearing Controls Crankshaft End Play.

ASSEMBLING OIL SEALS IN FILLER BLOCK AND OIL GUARD

Continental L-head engines have 3 types of crankshaft and oil pan seals.

The first type is jute packing which is used in fitting the filler block and oil guard in block to crankshaft.

The second type is a neoprene seal which is used in sealing the oil pan to the filler block.

The third type is a neoprene circular spring type which is currently used on the N-series engines.

JUTE TYPE OIL SEALS

First, remove the filler block and oil guard, after being the semi-circular die casting which fits in the cylinder block just to the rear of the rear crank pin bore. Clean out the grooves thoroughly. Clean the outer surface of this oil guard so as to remove all dried cement and grease.

Use the packing for crankshaft seal as it is received is approximately one-third larger in diameter than the width of the groove. To fit the grooves in the filler block, this must be crushed in a vise or flattened with a hammer on a flat surface so the jute packing is narrow enough to fit into the grooves.

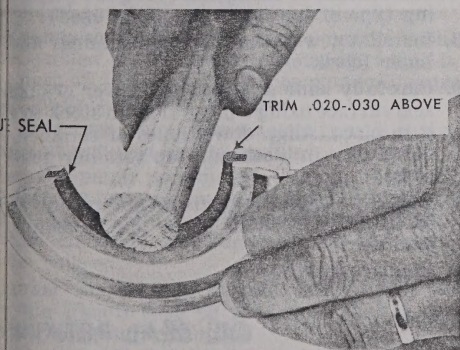


Figure 160 — Top Half of Rear Seal

Next, press it into the grooves of both the filler block and the oil guard. Then, using a piston pin, tooth hammer handle or some other instrument with a rounded surface, iron this packing into the grooves so that it is seated firmly and expanded so it seals the sides.

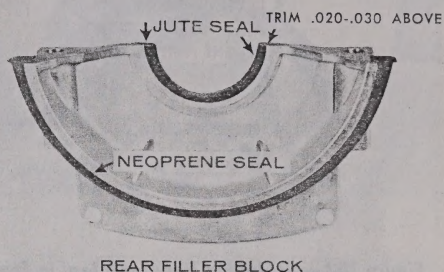


Figure 161 — Lower Half of Rear Seal

In its present condition the packing will protrude from the grooves at either end in varying amounts. With a sharp knife, or razor blade, cut this off to project .020-.030 above, making the cut parallel to the surface of the casting. Then slip it into place, either around the crankshaft, if the engine is still assembled, or directly into the groove if the crankshaft is out.

NEOPRENE OIL SEAL

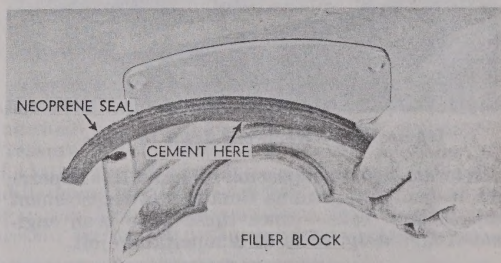


Figure 162 — Installing Neoprene Seal in Rear Filler Block

1. To replace neoprene seal, thoroughly clean all cement, dirt, and oil from the contacting surface of the filler block. To hold seal in place for assembly, use **only a small spot of non-hardening cement** in the center of the contacting surface, before inserting seal in groove. **No other cement is required.**

Lubricate outside of neoprene seals before installing oil pan to prevent possible distortion of seals.

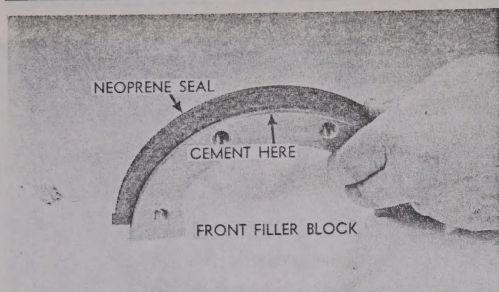


Figure 163 — Installing Neoprene Seal in Front Filler Block

2. Neoprene seal on front filler block is installed in the same manner.

When replacing gear cover, cement gasket to gear cover with a quick drying gasket cement and reassemble to engine block.

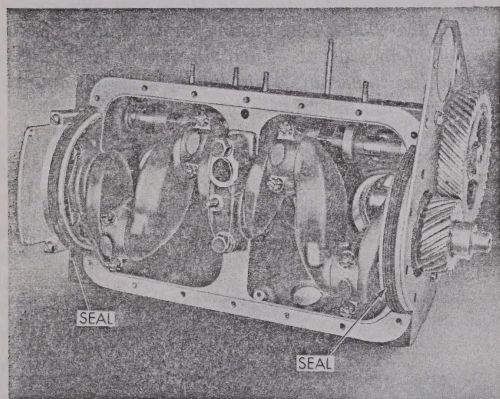


Figure 164 — Neoprene Seals in Place

In order to prevent possible oil leaks, it is imperative to use **only** genuine Continental replacement gaskets and seals — since these have been engineered and designed to do a superlative job.

NEOPRENE CIRCULAR SPRING TYPE SEAL

The "N" series of engines uses a circular spring type seal which is replaced as follows:

1. Remove flywheel assembly.
2. Remove cap screws from oil seal retainer assembly.
3. Remove retainer from 2 dowel pins and slide off seal surface of crankshaft.
4. Press oil seal from retainer with a driver slightly smaller than seal diameter. Thoroughly clean back of cylinder block and retainer in a solvent.
5. On an arbor press, press in new seal with driver which fits oil seal to prevent damage to seal. If a driver of the correct diameter is not avail-

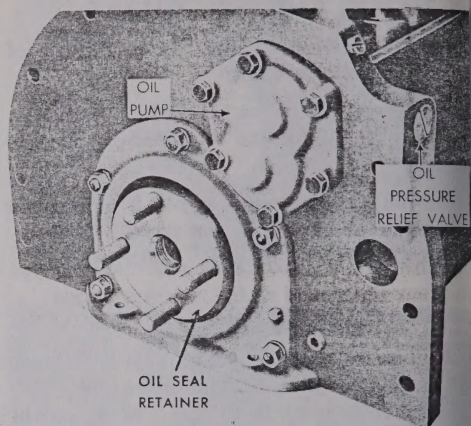


Figure 165 — "N" Series Circular Spring Type Seal

able, use a piece of $\frac{1}{4}$ " sheet steel, 8" x 8" larger, and press seal into retainer on an arbor press. Be sure the seal wiping edge and spring face is toward engine.

6. Examine crank flange seal surface carefully. Any roughness or scratches should be polished off, otherwise they will damage new seal.
7. Apply coat of fibre lubricant to seal as well as seal surface of crankshaft (A good wheel bearing type of lubricant should be used).
8. Install a new gasket between retainer and cylinder block.
9. Carefully slide seal assembly over crankshaft seal surface using a piece of shim stock to guide it in place. Align dowel holes of retainer with dowel pins in block and tap retainer gently in place.
10. Replace retainer cap screws and torque evenly to 15 - 20 ft. pounds so as not to distort retainer.
11. Replace flywheel.

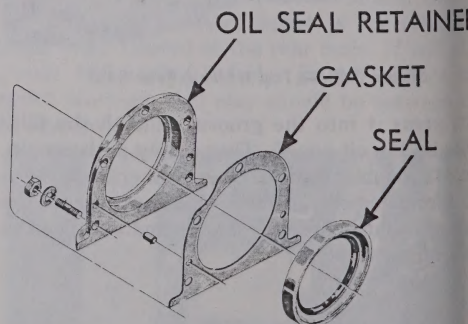


Figure 166 — Exploded View of Oil Seal Retainer and Seal

OIL PUMPS

The oil pump is assembled to the center main bearing, held in position vertically against a main bearing pad by studs, (except the "N" series engine, which have the oil pump on the rear end of and driven off end of camshaft.)

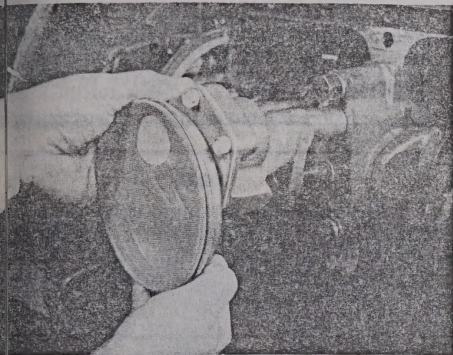


Figure 167 — Oil Pump Removal

The extended portion of the body acts as a pilot, fitting closely in a reamed hole in the main bearing housing, maintaining definite relationship between the camshaft and the oil pump drive shaft.

A gear is assembled to the upper end of this shaft, driven by a mating gear cut on the camshaft and meshing with the oil pump gear which is assembled to the lower end of the pump shaft.

The pump shaft is carried in two bronze bushings assembled in the cast iron housing, which is a part of the oil distributing system, transmitting oil to the drilled passages.

The gear type pump has a capacity well in excess of that required by the engine.

When the pump is removed, examine the drive shaft carefully for wear, inspecting the gear on the camshaft at the same time. If scored or worn badly, replace the camshaft and the gear on the pump shaft be replaced.

Examine the pick-up screen (which may be either the Floato type or the stationary screen) for clogging or damage.

Remove the cover, being careful not to damage the head gasket which acts as a spacer as well as a gasket to seal the joint.

Examine the gears and pump body for any signs of wear indicating lack of clearance. The gears should have from .001 to .003 clearance in the mesh and should make no contact with the cover.

Inspect the cover and face of the gears for excessive wear or scoring. With the gasket assembled to the body there should be .0015 - .006 clearance between the gears and the cover.

Worn or scored gears can be replaced, as can a worn cover. If the body shows wear in the chamber it can be replaced, but in a case like this a new pump would be the most economical.

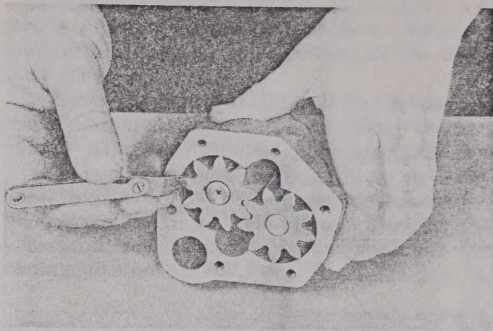


Figure 168 — Checking Oil Pump Gear Clearance in Body

Engine oil pressure must be maintained to specification for satisfactory engine life.

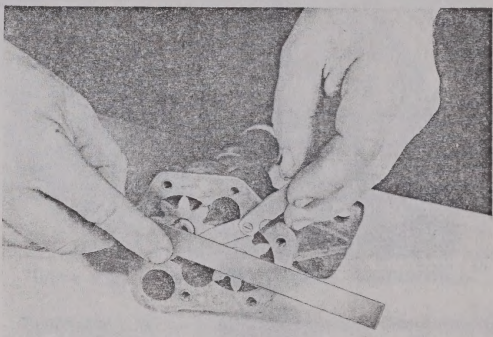


Figure 169 — Checking Oil Pump End Clearance

Pressure relief is located externally on the right-hand side, near the oil pan flange at the center. (on the N series, it is located in the rear end plate). Pressure is controlled by a plunger and spring, the latter specifically for a certain range. The only adjustment variation is either to change springs or assemble or remove washers from behind the present spring. Up to four washers are permissible.

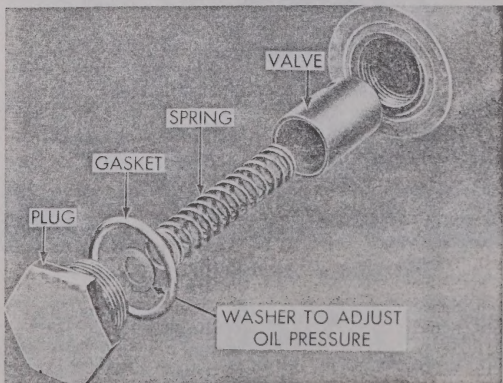


Figure 170 — Oil Pressure Relief Valve

CAUTION

On several models of our L-Head engine, a $\frac{1}{8}$ " flat spacer washer is used between the pump mounting lug and the center main bearing cap. When reassembling, be **SURE** this washer is placed on the oil pump mounting stud before the oil pump is installed in place. Failure to do this will cause interference between oil pump and camshaft and not allow the distributor drive to mesh correctly.

NOTE

When replacing oil pump drive gear (It 23, Fig. 171) it is necessary to line up the hole in the gear with the hole in shaft and drill through the other half of the gear before pinning in place.

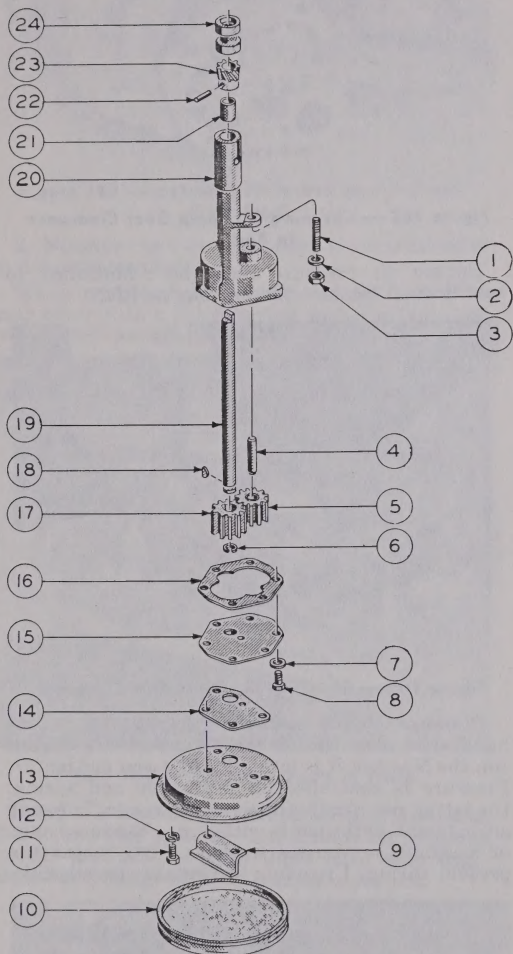


Figure 171 — Typical Oil Pump

- | | |
|-----------------|----------------------|
| 1. Stud | 13. Frame — oil pump |
| 2. Washer | screen |
| 3. Nut | 14. Gasket |
| 4. Stud | 15. Cover — oil pump |
| 5. Gear — idler | 16. Gasket |
| 6. Snap ring | 17. Gear — driver |
| 7. Washer | 18. Key |
| 8. Screw | 19. Drive shaft |
| 9. Spacer | 20. Body assembly |
| 10. Screen | 21. Bushing |
| 11. Screw | 22. Pin |
| 12. Washer | 23. Gear |
| | 24. Bushing |

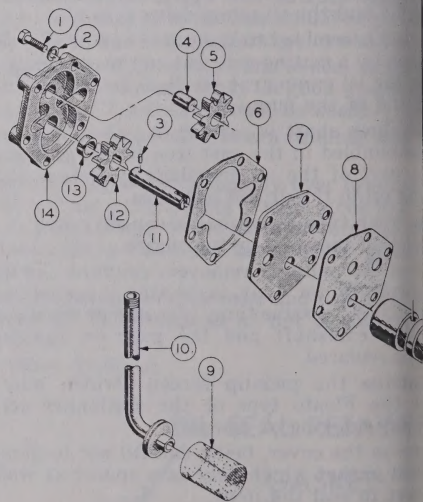


Figure 172 — "N" Series Oil Pump

- | | |
|---------------|-------------------|
| 1. Screw | 8. Gasket |
| 2. Lockwasher | 9. Screen |
| 3. Pin | 10. Tube assembly |
| 4. Stud | 11. Shaft |
| 5. Idler gear | 12. Gear |
| 6. Gasket | 13. Bushing |
| 7. Cover | 14. Body |

FLYWHEEL AND FLYWHEEL HOUSING

The flywheel is machined and balanced so that the clutch face and locating counterbore will run true with its axis.

Be sure that the crankshaft flange has not been sprung or otherwise damaged or that the counterbore in the flywheel, which locates it on the crankshaft, is not damaged, mount an indicator on the flywheel housing and check the flywheel for runout. Caution: When checking runout remove spark plugs to allow engine to be turned over freely.

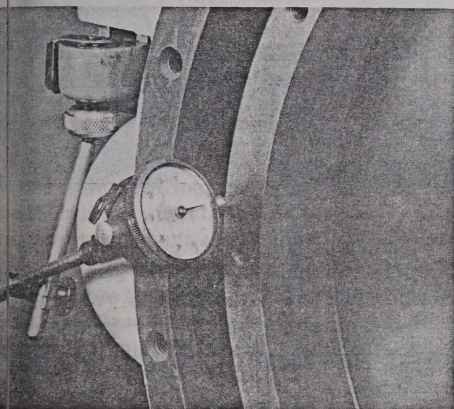


Figure 173 — Checking Flywheel Run-Out

The indicator should be set up so that it contacts the clutch face or the vertical surface of the clutch counterbore, then turn the flywheel at least one revolution at the same time holding against the crankshaft to offset the possibility of end play.

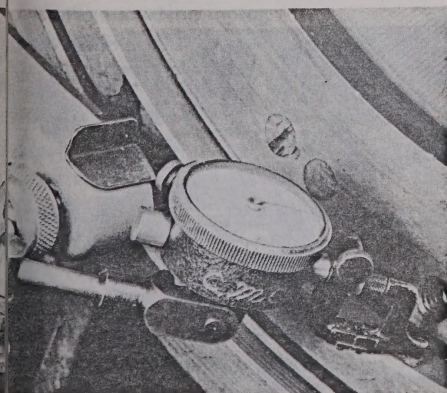


Figure 174 — Checking Flywheel Counterbore

Excessive runout of the flywheel, in either position, is probably caused by dirt in or damage to counterbore locating the flywheel on the crankshaft flange.

Re-locate the indicator to check the inside diameter of the counterbore. In both cases the maximum indicator reading must not be more than .008.

When assembled, mount the indicator on the flywheel so that it contacts the housing face and turn the crankshaft, at the same time holding against it to counteract end play. The maximum indicator reading must not exceed .008.

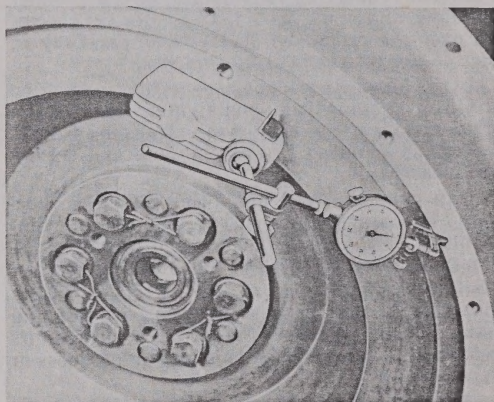


Figure 175 — Checking Flywheel Housing Face

Re-locate the indicator to contact the housing bore and check this in the same manner. The same runout limits prevail.

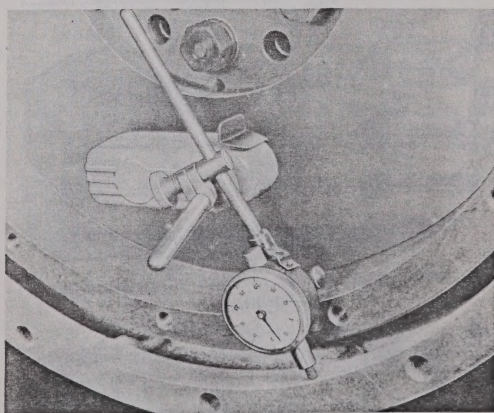


Figure 176 — Checking Housing Bore

If more than one engine is being rebuilt at a time, the housing should be identified with its original cylinder block and should be reassembled to that block in the rebuilding process.

REASSEMBLING ENGINE

In the foregoing, we have outlined procedures for checking, repairing or replacing the many wearing parts in the engine.

In most cases, the instructions have covered the reassembly of parts or subassemblies made up of several parts.

When reassembling pistons and connecting rods, use a good ring compressor and oil the bores thoroughly. A hammer handle may be used to bump the pistons out of the ring compressor into the cylinder bore.

Once more, we call attention to care demanded to prevent connecting rods damaging the cylinder bore finish and at the same time as they are assembled over the crank pin, locate them carefully in order to protect the bearing surfaces.

Always lubricate the bearings with clean engine oil when assembling, and tighten them to the torque specified. Use lockwires, cotter pins or lockwashers as required to prevent nuts and screws from loosening.

Clean cylinder head and block surfaces thoroughly before installing gasket. Tighten all cylinder heads or cap screws evenly and torque in following sequence to the recommended torque.

Before assembling the oil pan with new gaskets make certain that gasket surfaces are flat and clean. Tighten screws in accordance with limits prescribed in torque chart — to avoid looseness or overstressing.

Torque Specifications for Cylinder Head Tightening Sequence in Foot Pounds

Size - Diameter	$\frac{3}{8}$ "	$\frac{7}{16}$ "	$\frac{1}{2}$ "	$\frac{9}{16}$ "	$\frac{5}{8}$ "
Cylinder Heads	35-40	70-75	100-110	130-140	145-155

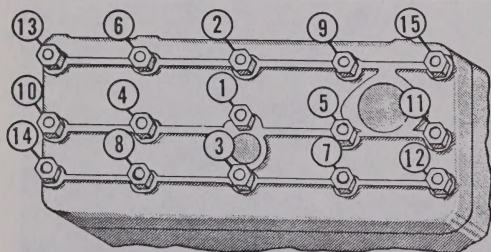


Figure 177 — Cylinder Head Tightening Sequence — Four Cylinder

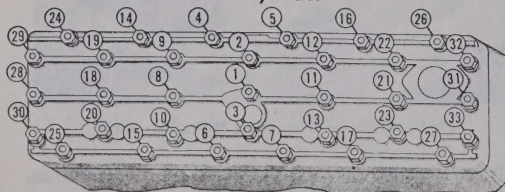


Figure 178 — Cylinder Head Tightening Sequence — Six Cylinder

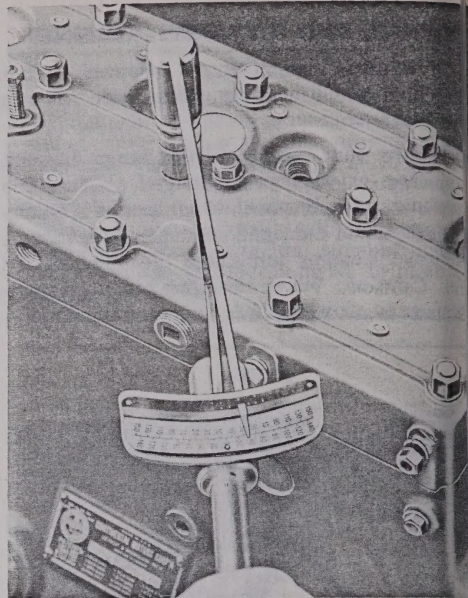


Figure 179

When engine is completely assembled and filled with proper oil, (See Lubrication Sec.) set tappet according to the following chart:

MODEL	INTAKE	EXHAUST
Y112, F135, F163	.012	.020
F227, F245	.012	.020
M330, M363	.017	.020
B427	.017	.022

Please check your engine nameplate for the correct setting.

NOTE: Tappet settings for previous models are listed on pages 5

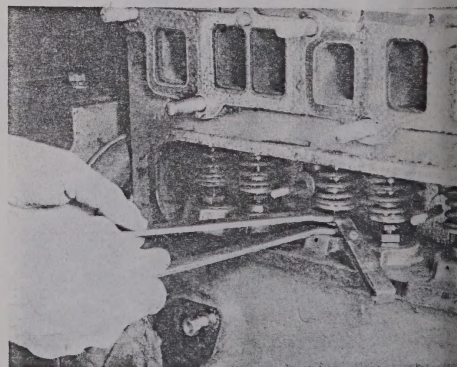


Figure 180 — Setting Tappets

SECTION IX TROUBLE SHOOTING

preventive maintenance system including inspection, lubrication and adjustment as recommended in our Maintenance Section will prevent greater portion of gasoline engine troubles.

Failure of a gasoline engine to start is mainly two things: ignition trouble or failure in the system.

Operators handling the same engine every day, develop a sense of impending trouble when normal operation occurs. Immediate attention these danger signals can prevent major failures, dependable operation and increase the life of the engine.

Operators should depend on their well-developed sense of feeling, hearing, seeing and smelling and use their sense of taste in this type of work — a generous amount of "Common-Sense".

Good rule to follow in locating trouble is to make more than one adjustment at a time — locate the trouble by a process of elimination. Remember the cause is usually Simple — rather mysterious and complicated.

Following are listed some of the normal complaints encountered in routine operation of all gasoline engines and the probable causes.

STARTING MOTOR — WILL NOT CRANK ENGINE:

- Weak or dead battery.
- Poor ground connection.
- Faulty starting switch or relay.
- Defective starting motor.
- Internal engine seizure — turn engine manually to determine cause.

ENGINE CRANKS — BUT DOES NOT START:

Disconnect one spark plug wire, turn ignition on, cracker cranking engine and free end of wire from cylinder head — note spark.

NO SPARK:

(A) — **If Ammeter Shows No Discharge** — it indicates an open primary circuit due to:

- 1 — Points not closing.
- 2 — Open primary wires.
- 3 — Defective ignition switch.
- 4 — Faulty coil.

(B) — Normal Ammeter Reading (2-5 Amps)

— this indicates that primary circuit is OK — trouble may be in secondary circuit due to:

- 1 — Broken or grounded high tension wire from coil to distributor.
- 2 — Wet high tension wires.
- 3 — Faulty distributor cap or rotor.
- 4 — Broken secondary winding of coil.

(C) — Excessive Ammeter Reading (over 5 Amps)

— indicates a "short" in the primary winding which may be due to:

- 1 — Shorted or grounded primary winding.
- 2 — Distributor or magneto points not opening.
- 3 — Grounded breaker point arm.
- 4 — Defective condenser.

2 — WEAK SPARK — may be caused by:

- (A) Loose ignition wiring connections.
- (B) Burned or pitted distributor points.
- (C) Wet spark plug wires.
- (D) Defective condenser.
- (E) Cracked distributor cap.
- (F) Weak ignition coil.

3 — GOOD SPARK AT EACH PLUG — indicates that ignition system is OK and trouble is in fuel system — which may be due to:

(A) **No Gas in Carburetor** — which may be due to:

- 1 — No gas in tank.
- 2 — Clogged filter or lines.
- 3 — Faulty fuel pump.
- 4 — Leaky fuel line from tank.
- 5 — Plugged vent in fuel tank cap.

(B) **Gas in Carburetor** — which may be flooded due to:

- 1 — Too much choking — plugs are wet.
- 2 — Wrong float level.
- 3 — Choke not operating correctly.
- 4 — Water in Gas.

C — ENGINE RUNS WITH CONTINUOUS MIS-FIRING: Due to:

- 1 — Uneven compression.
- 2 — Wet or deteriorated high tension wires.
- 3 — Cracked distributor cap.
- 4 — Faulty spark plugs—if spark plug porcelain is white when removed, use **Colder** plug — if light brown OK — if Black or oily use **Hotter** plug.

D — ENGINE RUNS UNEVENLY

- 1 — **At Idling Speed**—which may be due to:
 - (A) Too wide spark plug gaps.
 - (B) Poor Carburetor idle adjustment.
 - (C) Wrong float level.
 - (D) Carburetor or intake manifold air leaks.
 - (E) Leaky cylinder head gasket.
- 2 — **At High Speed** — which may be due to:
 - (A) Wide breaker points.
 - (B) Weak distributor breaker arm spring
 - (C) Weak valve springs.
 - (D) Spark plug of wrong type or incorrect gap.

E — ENGINE RUNS IMPROPERLY

- 1 — **Back-Firing into Manifold** — indicates **Too Rich** a fuel mixture; into carburetor indicates **Too Lean** a mixture—may be due to:
 - (A) Late Ignition Timing.
 - (B) Clogged Air Cleaner.
 - (C) Fuel line restrictions.
 - (D) Clogged carburetor jets.
 - (E) Sticking Valves.
 - (F) Weak or broken valve springs.
- 2 — **Excessive Ping (Detonation)**—Results in damaged pistons and bearings and is caused by pre-ignition or using inferior grade of gas.
- 3 — **Engine Idles Too Fast** — indicates improper throttle adjustment or weak throttle return springs.
- 4 — **Engine Dies When Idling** — which indicates incorrect speed or mixture adjustment; clogged idling circuit in carburetor or wrong choke adjustment, or air leaks in intake manifold.
- 5 — **Engine "Stumbles" on Acceleration** — which may be due to defective accelerator pump or air in fuel lines.

6 — Defective Spark Plugs.

F — LACK OF POWER — which may be due to:

- 1 — Poor Compression.
- 2 — Wrong Timing.
- 3 — Throttle control not opening fully.
- 4 — Air leak in fuel system.
- 5 — Restriction in air cleaner — should have vacuum less than 10" water.
- 6 — Exhaust line obstructed — should have back pressure of not more than 20" water.
- 7 — Poor fuel.
- 8 — Piston rings sticking or worn.

G — POOR COMPRESSION—check with compression gauge — if irregular, seal the piston with a teaspoonful of engine oil poured through spark plug hole, and take a second reading. If pressure does not increase this will indicate that poor seating of valves are at fault. Poor compression may be due to:

- 1 — Valves holding open — no tappet clearance.
- 2 — Leaky cylinder head gasket.
- 3 — Broken or weak valve springs.
- 4 — Burned or sticking valves.
- 5 — Badly worn, broken or stuck piston rings.
- 6 — Wrong valve timing.

H — OVERHEATING

- 1 — Lack of water in radiator.
- 2 — Fan belts slipping.
- 3 — Thermostat sticking or inoperative.
- 4 — Radiator clogged or leaky.
- 5 — Late ignition timing.
- 6 — Back pressure in exhaust line.
- 7 — Defective water pump.
- 8 — Overloading of engine.

I — LOW OIL PRESSURE

- 1 — Low Oil level.
- 2 — Oil pressure gauge or line faulty.
- 3 — Oil too light — diluted.
- 4 — Suction screen plugged.
- 5 — Dirt in relief valve or broken spring.
- 6 — Worn bearings.
- 7 — Worn or damaged oil pump gears.
- 8 — Worn Cam Bushings.

HIGH OIL PRESSURE—should not exceed recommended pressures except when engine is starting up cold. Abnormally high oil pressure is not desirable because it increases oil consumption — possible causes of high oil pressures are:

- 1 — Engine oil too heavy.
- 2 — Stuck relief valve.
- 3 — Obstruction in distributing line.
- 4 — Faulty oil pressure gauge.

HIGH OIL CONSUMPTION

- 1 — Oil leaks.
- 2 — Too high oil level.
- 3 — Incorrect grade of oil used.
- 4 — Clogged crankcase breather.
- 5 — Oil pressure too high — stuck relief valve.
- 6 — Piston rings not run-in, due to too smooth cylinder bore finish or glazed condition.
- 7 — Worn, broken or stuck piston rings and clogged oil control rings.
- 8 — Worn pistons and sleeves.
- 9 — Worn bearings.
- 10 — Worn valve guides.

(Manifold may be removed for visual inspection.)

ENGINE KNOCKS AND OTHER NOISES

- 1 — Operating Knocks — which may be due to:

(A) **Pre-Ignition** — Most common cause is due to wrong type plugs which are too hot.

(B) **Carbon** — noticeable when engine is accelerated while hot — clean head and pistons.

(C) **Timing**—early timing causes knocks similar to carbon — but may tend to kick back when starting.

(D) **Fuel** — detonation knock caused by poor gas.

(E) **Overloads** — particularly at lower operating speeds.

- 2 — **Mechanical Knocks**—result from wear, abuse or improper adjustments — which may be due to:

(A) **Crankshaft and Main Bearings:**

(1) **Worn or burned-out Main Bearings** — A heavy, dull knock when accelerating under load. Locate by shorting out plugs on both sides of the bad bearing.

(2) **Crankshaft End-Play** — excessive end-play is indicated by an intermittent

knock which will come and go when the load is released and engaged.

(B) Connecting Rod Bearings

(1) **Worn or Burned-out Bearings** — The worst condition, a light pound or metallic knock, is noted at idling and to about $\frac{2}{3}$ maximum speed. Bad bearings can be determined by shorting out plugs.

(C) Pistons and Wrist-Pins

(1) **Loose Wrist Pins** — noise doubles when the correct plug is shorted out — most noticeable at idling speed.

(2) **Piston Loose in Cylinder** — "Piston-Slap" is noted by metallic knocking at low speed under load; but disappears at high speed — also most noticeable when starting cold — test by shorting out plugs.

(D) Broken Piston Ring or Pin

sharp clicking noise that won't short out.

(E) Valves

(1) **Burned Valves and Seats** — engine misses, especially at low speeds, or acceleration under load.

(2) **Weak or Broken Valve Springs** — missing at low or high speeds when under load.

(3) **Sticking Valves** — loss of power and popping sound when bad.

(4) **Tappet noise** — excessive clearances cause noise when cold — which diminishes at normal operating temperature.

(F) **Camshaft** — Noise due to loose bearings or end play — usually occurs at half engine speed.

(G) **Timing Gear Noise** — Loose or worn gears rattle or knock — tight gears hum.

3 — **Vibration Originating at Engine** — The most common sources of vibration originating in or on the engine, as distinguished from causes created outside the engine are as follows:

(A) **Misfiring**

(B) **Misalignment of engine**

(C) **Bent or off-center coupling**

(D) **Engine loose on bed and type of mountings.**

(E) **Out of balance condition of flywheel and clutch assembly.**

SECTION X

TORQUE SPECIFICATIONS

Continental L-Head engines have many studs, bolts, and cap screws of special material and sizes and it is very important that special care be exercised to replace all studs and bolts in their respective locations during assembly of engine.

The torque specifications, foot pounds, listed below, **MUST** be followed in order to have the assembled engine conform to the original specifications:

Size-Diameter	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"
Cylinder Heads	.....	35-40	70-75	100-110	130-140	145-150
Main Bearing Caps	.....	35-40	70-75	85-95	110-120	140-150
Connecting Rods	20-25	40-45	55-60	90-100	110-120	.....
Flywheels	20-25	35-40	70-75	85-95	100-110	145-150
Manifolds	15-20	25-30	40-50	50-60	50-60	60-70
Gear Covers, Water Pumps, Front and Rear End Plates	15-20	25-30	50-55	80-90	.....	.....
Oil Pans	12-16	12-16	.....	.....	.....	.....
Flywheel Housings	15-20	25-30	50-55	80-90	115-125	.....

Camshaft Nut

Thread Size	3/4"	7/8"	1"	1 1/8"	1 1/4"	
C.I. Shafts	65-70 #	70-80 #	95-100 #	125-130 #	145-150 #	
Forged Steel Shafts		*120-125 #	*175-180 #			
Elastic Stop Nut w/C.I. or Forged Steel Shaft		65-70 #				

*When Cam Gear Governor is used with a steel camshaft, torque cam nut to 85-90 #

SECTION XI

LIMITS AND CLEARANCE DATA

NOTE: DIMENSIONS SHOWN ARE FOR
STANDARD ENGINES

Model	N-56 N-62	Y-69 Y-91 Y-112	F-124 F-140 F-162 F-244	F-186 F-209 F-226	F-135 F-163 F-227 F-245	M-271 M-290 M-330 M-363	B-371 B-427	
Valve	INTAKE AND EXHAUST	INTAKE AND EXHAUST	INTAKE AND EXHAUST	INTAKE AND EXHAUST	INTAKE AND EXHAUST	INT. EXH.	INT. EXH.	
	1 ¹ / ₃₂	2 ¹ / ₃₂	2 ¹ / ₁₆	2 ¹ / ₁₆	2 ¹ / ₁₆	3 ¹ / ₁₆ 3.0	2 ⁷ / ₈ 3 ¹ / ₁₆	
Max. Dia.	.5645/.5635 .3169/.3159 .3184	.5645/.5635 .3167/.3157 .3182	.6575/.6565 .3432/.3422 .3447	.6575/.6565 .3432/.3422 .3447	.6575/.6565 .3432/.3422 .3447	.752/.751 .4067/.4057 .4082	.814/.813 .4370/.4360 .4385	
Lock Guide	25 ¹ / ₃₂	7 ¹ / ₈	1 ¹ / ₃₂	1 ¹ / ₃₂	1 ¹ / ₃₂	1 ¹ / ₄ 1 ¹ / ₁₆	1 ¹ / ₈ 1 ¹ / ₁₆	
INTAKE								
Max. Dia.	.3149/.3141 .3121 30°	.3149/.3141 .3121 30°	.3414/.3406 .3386 30°	.3414/.3406 .3386 30°	.3414/.3406 .3386 30°	.4037/.4026 .4006 30°	.4340/.4329 .4309 30°	
Limits Max. Cl. Var.	.001/.0006 .003 .0008	.001/.0006 .003 .0008	.0026/.0008 .0046 .0015	.0026/.0008 .0046 .0015	.0026/.0008 .0046 .0015	.0036/.002 .0056 .002	.0036/.002 .0056 .002	
EXHAUST								
Max. Dia.	.3132/.3124 .3104 45°	.3132/.3124 .3104 45°	.3385/.3377 .3357 45°	.3385/.3357 .3357 45°	.3385/.3377 .3357 45°	.4014/.4007 .3987 45°	.4315/.4305 .4285 45°	
Limits Max. Cl.	.0047/.0043 .0063 .0035	.0047/.0043 .0063 .0035	.0055/.0037 .0075 .0045	.0055/.0037 .0075 .0045	.0055/.0037 .0075 .0045	.0055/.0043 .0075 .0045	.006/.0045 .008 .0045	
ROCKERS								
Max. Dia.	7 ¹ / ₈ 1 ³ / ₈	3 ¹ / ₃₂ 1 ⁴⁵ / ₆₄	3 ¹ / ₃₂ 1 ⁴⁵ / ₆₄	1.150/1.130 1 ²¹ / ₃₂	3 ¹ / ₃₂ 1 ⁴⁵ / ₆₄	1.302/1.282 1 ⁷ / ₈	1 ¹⁵ / ₁₆ 1.617	
Max. Wgt.	18-22 # 16 # 1 ¹ / ₈	47-53 # 42 # 1 ²⁷ / ₆₄	47-53 # 42 # 1 ²⁷ / ₆₄	47-53 # 42 # 1 ³ / ₈	47-53 # 42 # 1 ²⁷ / ₆₄	58-64 # 52 # 1.521	65 ¹ / ₂ -72 ¹ / ₂ 59 # 1.316	
Max. Wgt.	32-38 # 29 #	96-104 # 86 #	96-104 # 86 #	103-110 # 93 #	96-104 # 86 #	115-123 # 103 #	137-151 # 123 #	

LIMITS AND CLEARANCE DATA

Engine Model	N-56 N-62	Y-69 Y-91 Y-112	F-124 F-140 F-162	F-135**** F-163****	F-186 F-209	F-226 F-244	F-227*** F-245**	M-271 M-290 M-330 M-363	B-371 B-427
CAMSHAFT									
Big. Journal Dia. #1	1.7465/1.7455	1.8095/1.8085	1.8725/1.8715	1.8725/1.8715	1.8725/1.8715	1.8725/1.8715	1.8725/1.8715	2.1850/2.1840	2.2430/2.2420
#2	1.7465/1.7455	1.7465/1.7457	1.7465/1.7457	1.7465/1.7457	1.8095/1.8085	1.8095/1.8085	1.8095/1.8085	2.1225/2.1215	2.2430/2.2420
#3	1.7465/1.7455	1.7465/1.7457	1.7465/1.7457	1.7465/1.7457	1.7465/1.7457	1.7465/1.7457	1.7465/1.7457	2.0600/2.0590	2.2430/2.2420
#4	None	None	None	None	1.2475/1.2465	1.2475/1.2465	1.2475/1.2465	2.1850/2.1840	2.2430/2.2420
*Wear Limits—Min. Dia. Bushing—Inside Dia. #1	1.750/1.749	1.8125/1.8115	1.8755/1.8745	1.8755/1.8745	1.8755/1.8745	1.8755/1.8745	1.8755/1.8745	2.1870/2.1865	2.2450/2.2445
#2	1.750/1.749	1.7502/1.7495	1.7502/1.7495	1.7502/1.7495	1.8125/1.8115	1.8125/1.8115	1.8125/1.8115	2.1245/2.1240	2.2450/2.2445
#3	1.750/1.749	1.7505/1.7495	1.7505/1.7495	1.7505/1.7495	1.7502/1.7495	1.7502/1.7495	1.7502/1.7495	2.0620/2.0615	2.2450/2.2445
#4	(No Bushings)	None	None	None	1.2505/1.2495	1.2505/1.2495	1.2505/1.2495	1.7495/1.7490	2.2450/2.2445
Bushing—Clearance Limits	.004/.002	.004/.002	.004/.002	.004/.002	.004/.002	.004/.002	.004/.002	.003/.0015	.003/.0015
End Play	.007/.003	.007/.003	.009/.005	.009/.005	.009/.005	.009/.005	.009/.005	.008/.005	.009/.005
CONNECTING RODS									
Bush. Hole Dia.	.6067/.6057	.7632/.7622	.914/.913	.914/.913	.914/.913	.914/.913	.914/.913	1.313/1.312	1.500/1.499
Big. Hole Dia.	1.6240/1.6245	.6175/.6170	.0617/.0614	.0617/.0614	.0617/.0614	.0617/.0614	.0617/.0614	2.3745/2.3740	2.6870/2.6865
*Wear Limits—Min. Thk.	.0610	.0609	.0609	.0609	.0609	.0609	.0609	.0621/.0618	.0933/.0930
Dia.—Crank Pin	1.500-1.499	1.500-1.499	1.9375/1.9365	1.9375/1.9365	1.9375/1.9365	1.9375/1.9365	1.9375/1.9365	.0613	.0925
*Wear Limits—Min. Dia.	1.498	1.498	1.9355	1.9355	1.9355	1.9355	1.9355	2.248/2.249	2.498/2.499
Clearance Limits	.0005/.0025	.0006/.0027	.0006/.0027	.0006/.0027	.0006/.0027	.0006/.0027	.0006/.0027	2.247	2.497
Desired Clearance	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015
*Wear Limits—Max. Cl.	.0035	.0037	.0037	.0037	.0037	.0037	.0037	.0039	.004
Side Play	.010/.006	.0105/.006	.010/.006	.010/.006	.010/.006	.010/.006	.010/.006	.010/.006	.010/.006
Desired Side Play	.006	.0065	.006	.006	.006	.006	.006	.006	.006
MAIN BEARINGS									
Dia. of Big. Bore in Block	2.1710/2.1703	1.8747/1.8740	2.4372/2.4365	2.4372/2.4365	2.4372/2.4365	2.4372/2.4365	2.4372/2.4365	2.8122/2.8115	3.0627/3.0615
*Wear Limits—Min. Thk.	.0845/.0840	.0625/.0622	.0926/.0929	.0926/.0929	.0926/.0929	.0926/.0929	.0926/.0929	.0930/.0933	.0925
Dia. of Main Big. Jr.	2.000/1.999	1.7485/1.7475	2.3752/2.3744	2.3752/2.3744	2.3752/2.3744	2.3752/2.3744	2.3752/2.3744	2.624/2.623	2.874/2.873
*Wear Limits—Min. Dia.	1.998	1.7465	2.3734	2.3734	2.3734	2.3734	2.3734	2.622	2.872
Clearance Limits	.003/.0008	.0005/.0028	.0007/.0030	.0007/.0030	.0007/.0030	.0007/.0030	.0007/.0030	.0009/.0032	.0020
Desired Clearance	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0020	.0020
C/S End Play	.003/.008	.003/.008	.003/.008	.003/.008	.003/.008	.003/.008	.003/.008	.003/.008	.003/.008
PISTON PIN									
Length	1.925/1.920	2.066/2.056	2.504/2.489	2.504/2.489	2.504/2.489	2.504/2.489	2.504/2.489	3.190/3.175	3.365/3.355
Diameter	.5435/.5433	.7083/.7083	.8593/.8591	.8593/.8591	.8593/.8591	.8593/.8591	.8593/.8591	1.1093/1.1091	1.2500/1.2498
*Wear Limits—Min. Dia.	.5430	.7080	.8588	.8588	.8588	.8588	.8588	.8588	1.2495
Desired Fit	Light Push	Light Push	Light Push	Light Push	Light Push	Light Push	Light Push	Light Push	Light Push
Bush. Hole Dia.—Pin	.5438/.5436	.7089/.7087	.8597/.8595	.8597/.8595	.8597/.8595	.8597/.8595	.8597/.8595	1.1097/1.1095	1.2504/1.2502
*Wear Limits—Max. Dia.	.5448	.7099	.8607	.8607	.8607	.8607	.8607	1.1107	1.2514
Pin Cl. in Bushing	.0005/.0001	.0006/.0002	.0006/.0002	.0006/.0002	.0006/.0002	.0006/.0002	.0006/.0002	.0006/.0002	.0006/.0002
Desired Pin Fit	.0003	.0004	.0004	.0004	.0004	.0004	.0004	.0004	.0004

NOTE 1 — Y-91 PISTON PIN LENGTH 2.441/2.431

Y-112 PISTON PIN LENGTH 2.755/2.7543

NOTE 2 — F-140 PISTON PIN LENGTH 2.691/2.676

F-162 PISTON PIN LENGTH 2.978/2.968

NOTE 3 — F-209 PISTON PIN LENGTH 2.691/2.676

NOTE 4 — F-244 PISTON PIN LENGTH 2.978/2.968

NOTE 5 — M-271 PISTON PIN LENGTH 3.063/3.050

M-330 PISTON PIN LENGTH 3.440/3.425

M-363 PISTON PIN LENGTH 3.440/3.425

NOTE 6 — B-427 PISTON PIN LENGTH 3.630/3.620

SND CLEARANCE DATA

Model	N-56	N-62	Y-69	Y-91	Y-112	F-124	F-135	F-140	F-162	F-163
							PISTON NO. F135A00402			PISTON NO. F163A00403
Int. Cyl. Bore	2.252 / 2.250	2.377 / 2.375	2.502 / 2.500	2.877 / 2.875	3.1875 / 3.1895	3.002 / 3.000	3.1270 / 3.1250	3.1895 / 3.1875	3.4395 / 3.4375	3.4395 / 3.4375
Min. Dia.	.5436 / .5434	.5436 / .5434	.7086 / .7084	.7086 / .7084	.7086 / .7084	.8594 / .8592	.8597 / .8595	.8594 / .8592	.8597 / .8595	.8597 / .8595
ov/Width—#1	.096 / .095	.096 / .095	.0955 / .0945	.0955 / .0945	.0955 / .0945	.127 / .126	.081 / .080	.1265 / .1255	.1285 / .1275	.081 / .080
Limit Width	.098	.098	.0975	.0975	.0975	.129	.083	.1285	.1305	.083
ov/Width #2	.096 / .095	.096 / .095	.0955 / .094	.0955 / .094	.0955 / .094	.127 / .126	.0965 / .0955	.126 / .125	.1285 / .1275	.0965 / .0955
ea #3	.1885 / .1875	.1885 / .1875	.251 / .250	.251 / .250	.251 / .250	.127 / .126	.0965 / .0955	.126 / .125	.1285 / .1275	.0965 / .0955
Wh #2—	.098	.098	.0975	.0975	.0975	.1290	.0985	.1280	.1305	.0985
#3—	.1905	.1905	.253	.253	.253	.1290	.0985	.1280	.1305	.0985
ov/Width #4	None	None	None	None	None	.251 / .250	.189 / .188	.251 / .250	.253 / .252	.2515 / .2505
Limit Width	—	—	—	—	—	.253	.191	.253	.255	.2535
Per Gauge	.002	.002	.002	.002	.002	.003	.003	.003	.003	.003
Lbs. Pull	5-10 #	5-10 #	5-10 #	5-10 #	5-10 #	5-10 #	5-10 #	5-10 #	5-10 #	5-10 #

NGS

th #1	.0935 / .0925	.0935 / .0925	.0935 / .0925	.0935 / .0925	.0935 / .0925	.124 / .123	.078 / .077	.124 / .123	.124 / .123	.078 / .077
its Min. Width	.0905	.0905	.0905	.0905	.0905	.121	.075	.121	.121	.075
th #2	.0935 / .0925	.0935 / .0925	.0935 / .0925	.0935 / .0925	.0935 / .0925	.124 / .123	.094 / .093	.124 / .123	.124 / .123	.0930 / .0925
#3	.1865 / .1860	.1865 / .1860	.249 / .2485	.249 / .2485	.249 / .2485	.124 / .123	.094 / .093	.124 / .123	.124 / .123	.0930 / .0925
Wh #2	.0905	.0905	.0905	.0905	.0905	.121	.091	.121	.121	.0905
#3	.1840	.1840	.2465	.2465	.2465	.121	.091	.121	.121	.0905
th #4	None	None	None	None	None	.249 / .2485	.188 / .184	.249 / .2485	.249 / .2485	.248 / .244
its Min. Width	—	—	—	—	—	.2465	.182	.2465	.2465	.242
th #5	None	None	None	None	None	None	None	None	None	None
its Min. Width	—	—	—	—	—	—	—	—	—	—
Cl—#1	.013 / .005	.017 / .007	.015 / .007	.015 / .007	.013 / .008	.013 / .008	.008 / .018	.017 / .007	.017 / .007	.008 / .018
Cl—#2 & 3	.013 / .005	.017 / .007	#2—.015 / .007 #3—.013 / .005	#2—.015 / .007 #3—.013 / .005	#2—.013 / .008 #3—.016 / .008	.013 / .008	.008 / .018	.017 / .007	.017 / .007	.008 / .018
Cl—#4	None	None	None	None	None	.017 / .007	.015 / .055	.016 / .008	.017 / .007	.010 / .030
Cl—#5	None	None	None	None	None	None	None	None	None	None
Cl—#1	.0035 / .0015	.0035 / .0015	.003 / .001	.0025 / .001	.003 / .001	.004 / .002	.002 / .004	.0035 / .0015	.0055 / .0035	.002 / .004
Cl—#2	.0035 / .0015	.0035 / .0015	.003 / .001	.0025 / .001	.003 / .001	.004 / .002	.0015 / .0035	.0035 / .0015	.0055 / .0035	.0025 / .004
#3	.0025 / .001	.0025 / .001	.0025 / .001	.0025 / .001	.0025 / .001	.0025 / .001	.000 / .005	.0025 / .001	.0045 / .003	.0025 / .0075
Cl—#4	None	None	None	None	None	.0025 / .001	.000 / .005	.0025 / .001	.0045 / .003	.0025 / .0075

CAMSHAFT BORE IN BLOCK — FINISH REAMED

Model	Front	Front Interm.	Center	Rear Interm.	Rear
N56	1.749	None	None	None	1.249
	1.748				1.248
N62	1.750	None	None	None	1.250
	1.749				1.249
Y400	1.9375	None	1.8750	None	1.3750
	1.9370		1.8745		1.3745
F400	2.0000	None	1.8750	None	1.3750
	1.9995		1.8740		1.3745
F600	2.0000	1.9375	None	1.8750	1.3750
	1.9995	1.9370		1.8745	1.3745
M600	2.3750	2.3125	None	2.2500	1.9375
	2.3740	2.3115		2.2490	1.9365
B600	2.3750	2.3750	None	2.3750	2.3750
	2.3740	2.3740		2.3740	2.3740

Ring Width—# 1	.124 / .123	.124 / .123	.124 / .123	.078 / .077	.124 / .123	.078 / .077
*Wear Limits—Min. Width	.121	.121	.121	.075	.121	.075
Ring Width—# 2 & 3	.124 / .123	.124 / .123	.124 / .123	.0930/.0925	.124 / .123	.0930/.0925
*Wear Limits—Min. Width	.121	.121	.121	.0905	.121	.0905
Ring Width—# 4	.249 /.2485	.249 /.2485	.249 /.2485	.248 /.244	.249 /.2485	.248 /.244
*Wear Limits—Min. Width	.2465	.2465	.2465	.242	.2465	.242
Ring Width—# 5	None	None	None	None	None	None
*Wear Limits—Min. Width	—	—	—	—	—	—
Ring Gap Clearance—# 1	.013 / .008	.017 / .007	.020 / .010	.008 / .018	.017 / .007	.008 / .018
Ring Gap Clearance—# 2 & 3	.013 / .008	.017 / .007	.020 / .010	.008 / .018	.017 / .007	.008 / .018
Ring Gap Clearance—# 4	.017 / .007	.017 / .007	.016 / .008	.010 / .030	.017 / .007	.010 / .030
Ring Gap Clearance—# 5	None	None	None	None	None	None
Ring Side Clearance—# 1	.004 / .002	.0055 / .0035	.0035 / .0015	.002 / .004	.005 / .0035	.002 / .004
Ring Side Clearance—# 2 & 3	.004 / .002	.0055 / .0035	.003 / .001	.0025 / .004	.0055 / .0035	.0025 / .004
Ring Side Clearance—# 4	.0025 / .001	.0045 / .003	.0025 / .001	.0025 / .0075	.0045 / .003	.0025 / .0075
Ring Side Clearance—# 5	None	None	None	None	None	None

LIMITS AND CLEARANCE DATA

Engine Model	M-290	M-330	M-363	B-371	B-427
ADJUSTMENTS					
Cylinder Dia.	3.752 / 3.750	4.002 / 4.000	4.000 / 3.9995	4.127 / 4.125	4.3145 / 4.3125
Valve Limits—Cyl. Bore	.008	.008	.008	.008	.008
Piston Pin Hole Dia.	1.1096 / 1.1094	1.1096 / 1.1094	1.1097 / 1.1095	1.2503 / 1.2501	1.2503 / 1.2501
Ring Groove Width—# 1	.1275 / .1265	.1275 / .1265	.0975 / .0965	.1275 / .1265	.0975 / .0965
Valve Wear Limits	.1295	.1295	.0995	.1295	.0995
Ring Groove Width—# 2-3	.1265 / .1255	.1265 / .1255	.0975 / .0965	.1265 / .1255	.0975 / .0965
Valve Wear Limit	.1285	.1285	.0995	.1285	.0995
Ring Groove Width—# 4	.1895 / .1880	.1895 / .1880	.1885 / .1875	.251 / .250	.251 / .250
Valve Wear Limit	.1915	.1915	.1915	.2530	.2530
Ring Groove Width—# 5	.1895 / .1880	.1895 / .1880	.1895 / .1880	.1885 / .1875	.1885 / .1875
Valve Wear Limit	.1915	.1915	.1915	.1905	.1905
Piston Fit—Feeler Gauge	.005	.005	.003	.005	.005
Lbs. Pull	5-10 #	5-10 #	5-10 #	5-10 #	5-10 #
PISTON RINGS					
Ring Width—# 1	.124 / .123	.124 / .123	.0935 / .0930	.124 / .123	.0935 / .0930
Valve Limits—Min. Width	.121	.121	.0910	.121	.0910
Ring Width—# 2 & 3	.124 / .123	.124 / .123	.0935 / .0930	.124 / .123	.0935 / .0930
Valve Limits—Min. Width	.121	.121	.0910	.121	.0910
Ring Width—# 4	.1865 / .1860	.1865 / .1860	.1865 / .1860	.249 / .2485	.249 / .2485
Valve Limits—Min. Width	.184	.184	.1840	.2465	.2465
Ring Width—# 5	.1865 / .1855	.1865 / .1855	.1865 / .1860	.1865 / .1855	.1865 / .1855
Valve Limits—Min. Width	.1835	.1835	.1840	.1835	.1835
Ring Gap Clearance—# 1	.013 / .008	.013 / .008	.025 / .013	.016 / .011	.023 / .013
Ring Gap Clearance—# 2 & 3	.018 / .008	.016 / .011	.023 / .013	.016 / .011	.023 / .013
Ring Gap Clearance—# 4	.018 / .008	.020 / .010	.023 / .013	.017 / .007	.023 / .013
Ring Gap Clearance—# 5	.018 / .008	.016 / .011	.023 / .013	.017 / .007	.023 / .013
Ring Side Clearance—# 1	.0045 / .0025	.0045 / .0025	.0045 / .003	.0045 / .0025	.0045 / .003
Ring Side Clearance—# 2 & 3	.0035 / .0015	.0035 / .0015	.0045 / .003	# 2—.0045 / .0025 # 3—.0035 / .0015	.0045 / .003
Ring Side Clearance—# 4	.0035 / .0015	.0035 / .0015	.0025 / .001	.0025 / .001	.0025 / .001
Ring Side Clearance—# 5	.004 / .0015	.004 / .0015	.0035 / .0015	.003 / .001	.0025 / .001

F400A-5131-S

CYLINDER & CRANKCASE ASSY.
(SHORT ENGINE ASSY.)

Same as Sub-Assembly F400A-5131-S except:

ADD:

<u>PART NUMBER</u>	<u>PART NAME</u>	<u>QUANTITY</u>
F400A-51317-R	Cylinder & crankcase assy.	1
F145B-4011	Oil pan assembly	1
F400B-5221	Gear cover assembly	1
F162A-329	Cylinder head	1
X-20009	Stud: oil filter to cyl. head	2
F400B-255	Filter block to oil pan seal	2
X-6794	Screw & lockwasher	2
	2-Gear cover to frt. filler block	
X-5719	Screw & lockwasher: gear cover to crkcase	1
X-14220	Lockwasher: 1 Gear cover to crkcase	
	1 Gear cover to frt. end plate	
X-226	Lockwasher: 2 Gear cov. to crkcase	3
	1 Gear cov. to frt. end plate	
F162U-147	Service gasket set	1

OMIT:

F400A-5131-R	Cylinder & crankcase assy.	1
F400B-4529	Oil pan assembly	1
F400B-4141	Gear cover assembly	1
F162A-335	Cylinder head assembly	1
X-3236	Screw: oil filter to cyl. hd. plug	2
Y400B-237	Filler block to oil pan cork	2
X-203	Lockwasher: gear cov. to fil. blk. screws	2
X-270	Lockwasher: gear cover screw	1
X-14134	Lockwasher: gen. brkt. stud hole plug screw	1
X-2276	Spark plug hole cover	4
X-5821	Screw: gear cov. to frt. fil. blk.	2
X-5771	Screw & lockwasher: gear cov. to cyl.	1
X-3940	Screw: gen. brkt. stud hole plug	1
X-3236	Screw: oil filter stud hole to crkcase	2
X-14192	Copper washer, oil filter stud hole to crkcase	2
F162U-129	Service gasket set	1

CYLINDER & CRANKCASE SECTION 1

8-16-61
9-26-61
2-15-63
8-7-69

re-typed

1A-a

CYLINDER & CRANKCASE

F400A-51317-A

Cylinder & crankcase assembly (stripped)

Composed of: Cylinder and crankcase, caps, bearings, guides, inserts, support, screws, stud, plugs, pins, etc.

1

F400A-51317-C

Cylinder and crankcase assembly

Composed of:

"A" assembly plus pistons and rings

1

F400A-51317-I

Cylinder and crankcase assembly

Composed of:

"C" assembly plus complete valve mechanism

1

F400A-51317-S

Cylinder and crankcase assembly

Composed of:

"I" assembly plus connecting rods, crankshaft, camshaft, front end plate, gears, filler blocks, cylinder head, gaskets, gear cover assembly, oil pump assembly, oil pan assembly, studs, nuts, screws, washer, plugs, and lockwires

1

F162U-121

Service gasket set

1

X-14264

F400B-368	Cap, bearing, crankshaft (front)	1
F400B-367	Cap, bearing, crankshaft (center)	1
F400B-366	Cap, bearing, crankshaft (rear)	1
X-24294	Washer 3/8 x 1/8 between bearing cap and oil pump mounting lug	4
X-2986	Screw, crankshaft bearing cap to cylinder 1/2-13 x 2-1/2	2
X-3511	Screw, crankshaft bearing cap to cylinder 1/2-13 x 3-1/4	6
X-14455	Washer, plain, crankshaft bearing cap to cylinder screw 1/2	2
6SH-100	Wire, lock, crankshaft bearing cap to cylinder screw (front & rear)	2
	#19 x 10	
X-1333-B	Wire, lock, crankshaft bearing cap to cylinder screw (center) #19x12	1

1A-c

FILLER BLOCKS

D600B-340	Block, filler (front)	1
X-3924	Screw, filler block to crankcase (front) 5/16-18 x 7/8	2
X-297-A	Washer, lock, filler block to crankcase screw 5/16	2
F400B-255	Seal, filler block to oil pan (front)	1
D600B-406	Block, filler (rear)	1
X-2958	Screw, filler block to crankcase (rear) 5/16-18 x 2-5/8	2
X-297-A	Washer, lock, filler block to crankcase screw 5/16	2
F400B-255	Seal, filler block to oil pan (rear)	1
T427B-201	Seal, filler block to crankshaft (rear)	2
X-5798	Screw & lockwasher assembly, filler block to flywheel housing 1/4-20 x 5/8	2
D600B-305	Guard, oil, crankshaft bearing (rear)	1
F400B-251	Felt, rear bearing oil guard	1
X-3056	Screw, 1/4-20 x 5/8 lg, filler block to hsg.	2
X-201	Lockwasher, 1/4 filler block to hsg.	2

1A-d

HOLES COVERS & PLUGS

X-1954-B	Stud, fuel pump hole cover to cylinder 5/16-18 x 1-1/4	2
X-1801-E	Nut, fuel pump hole cover to cylinder stud 5/16-18	2
X-202	Washer, lock, fuel pump hole cover to cylinder stud 5/16	2
16EV-201	Gasket, fuel pump hole cover to cylinder	1
X-3940	Screw, plugging, generator bracket stud hole 3/8-16 x 5/8	1
X-14134	Washer, copper, generator bracket stud hole plugging screw 3/8	1
X-2236	Plug, hubbard, camshaft bushing (rear) 1-1/2	1
X-2207	Plug, hubbard, cylinder core hole 1-1/8	1
X-2202	Plug, hubbard, cylinder core hole 1-3/8	2
X-137-A	Plug, pipe, crankcase oil header 1/4 (C'sunk special)	2

FSL62-6055

CYLINDERHEAD SECTION 2

2A-a CYLINDER HEAD

F162A-329
X-18828
3XX-1803-E
3XX-1408
F400A-336

Head, cylinder
Stud, cylinder head to cylinder 7/16-20 x 3-15/32 (cylinder head insert)
Nut, cylinder head cylinder stud 7/16-20
Washer, plain, cylinder head to cylinder stud 7/16
Gasket, cylinder head to cylinder

1
15
14
13
1

2A-b CYLINDER HEAD PLUGS

X-3940
X-14134
X-2538
X-101-B
X-104

Screw, plugging, distributor adapter stud hole 3/8-16 x 5/8
Washer, copper, distributor adapter stud hole plugging screw 3/8
Plug, special, distributor drive hole
Plug, pipe, cylinder head thermometer hole 1/2 (c'sunk)
Plug, pipe ext. head 3/4 cylinder head-top rear

1
1
1
1
1
1

2A-c LIFTING EYE

F162A-253 F400A-210

Motor lifting eye 7/16-20 thd. cylinder head to crankcase-near center

1

3A-a

CRANKSHAFT

F400C-503	Crankshaft	1
F600C-205	Plate, thrust, crankshaft	1
A500C-204	Crankshaft oil thrower	1
F600-O-206	Crankshaft starting jaw	1
F600-O-205	Crankshaft starting jaw washer	1

3A-b

CRANKSHAFT BEARINGS

F162G-300 (MS13974-1)	Crankshaft bearing, front, upper and lower	2
F162G-204 (MS13987-1)	Crankshaft bearing, center, rear, upper and lower	4
	Bearing available in standard only	

FSL62-6055

4A-a

CONNECTING RODS

F218D-3021

CONNECTING ROD SECTION 4

Rod assembly, connecting (cylinder 1 & 3)
Composed of: *Not serviced separately
*1 F218D-3020 Rod & cap
2 F162G-202 Bushing
2 C600D-206 Bolts
2 X-18188 Nuts

2

F218D-3031

Rod assembly, connecting (cylinder 2 & 4)
Composed of: *Not serviced separately
*1 F218D-3030 Rod & cap
2 F162G-202 Bushings
2 C600D-206 Bolts
2 X-18188 Nuts
Cotter pin, connecting rod bolts

2

X-601

8

CONNECTING ROD BUSHINGS

4A-b

F162G-202 (MSL3994-1)

Bushings, connecting rod

Barings available in standard only

8

FSL62-6055

PISTON SECTION 5

5A-a

PISTON

FL62A-4171-A

Piston assembly (complete)

Composed of:

- 1 FL62A-417
- 1 FL62A-230
- 2 FL62A-229
- 1 FL62A-231
- 1 FL62A-232
- 2 FL62A-233

Piston assembly

- Composed of:
- 1 FL62A-417
- 1 FL62A-230
- 2 FL62A-229

FL62A-4171-E

- Piston (MSL3957-1)
- Piston pin (MSL3996-2)
- retaining ring (MSL3962-1)
- Piston ring-top groove-chrome (MSL3933-7)
- Piston ring-2nd groove (MSL3932-7)
- Piston ring-3rd & 4th groove (MSL3931-7)

- Piston
- Pin
- Ring

PISTON PIN BUSHING

FL62G-203 MSL3963-1)

Piston pin bushing

Pistons and rings available in std., .020 and .040 O.S. only

FSL62-6055

CAMSHAFT SECTION 6

6A-a

CAMSHAFT

F400I-421
Y400I-203
X-3897

Camshaft

Plate, thrust, camshaft

Screw & lockwasher, camshaft thrust plate to crankcase 5/16-18 x 5/8

1
1
1

6A-b

CAMSHAFT BUSHINGS

*F600G-295
1*Y400G-228
*Y400G-229

Bushing, camshaft (front) F226G-227 Service bushing

Bushing, camshaft (center) Y400G-231 service bushing

Bushing, camshaft (rear) Y400G-232 Service bushing

*Production bushings service bushings finish reamed available in kit #F400T-181

1
1
1

6A-c

TIMING GEARS

F400H-401
X-506
X-18156
~~P40-202~~
D600H-300
X-534

Gear, timing camshaft

Key, crankshaft timing gear to camshaft (WOODRUFF #6)

Nut, camshaft timing gear to camshaft 7/8-18 (E-Lo 79)

~~Lock, nut, camshaft timing gear to camshaft nut~~

Gear, timing crankshaft

Key, crankshaft timing, gear to crankshaft (Morton Hi-Pro #HP-808)

1
1
1
1
1
1
1

X-18498

7A-a GE R COVER

F400B-5221

1

- ✓ Cover assembly, gear
Composed of: *Not serviced separately
- *1 F400B-522 Cover
- 1 X-1555 Seal
- 1 F400B-383 Gasket
- Ring dowel, gear cover to crankcase
- Screw 7/16-14 x 1-1/2, gear cover to crankcase
- ✓ Screw & lockwasher assembly 3/8-16 x 2, gear cover to front filler block
- Screw Hex Head 3/8-16 x 2, gear cover to front filler block
- Copper washer, gear cover to filler block screws
- ✓ Lockwasher 3/8
- 2-Gear cover to cylinder
- ✓ 1-Gear cover to front end plate
- ✓ Screw & lockwasher assembly 3/8-16 x 1-1/8, gear cover to cylinder block

1 1 2 1 2 3

8TC-200
X-3368
X-6794

X-3299
X-14134
X-226

X-5719

X-3295

1 2

- Screw hex 3/8-16 x 1-1/8
- 1-Gear cover to end plate
- 1-Gear cover to filler block
- Screw & lockwasher assembly, gear cover to end plate
- Stud 3/8-16 x 1-11/16, gear cover to cylinder upper holes
- Nut 7/16-14, gear cover dowel screw
- Nut 3/8-16
- 2-Gear cover to cylinder
- 1-Gear cover to end plate
- Washer 7/16, lock
- ✓ 1-Gear cover to front end plate
- ✓ 1-Gear cover to crankcase

1 2 1 1 3

X-5823
X-4200
X-1803-H
X-1802-G

X-14220

2

7A-b

FRONT END PLATE

F400B-365
D600B-203
X-3386
X-3896
F400B-225
X-270

- Front end plate
- Ring dowel, front end plate
- Screw, front end plate to crankcase
- Screw & lockwasher assembly 5/16-18 x 3/4, front end plate to crankcase
- Gasket, front end plate to crankcase
- Washer 7/16 lock, front end plate to crankcase

1 1 1 1 1 1

FSL62-6055

VALVE SECTION 8

8A-a

VALVES & ASSOCIATED PARTS

F162I-201 (MSL3999-8)
 F162I-202 (MSL3999-3)
 F400A-288
 F162I-204 (MSL3998-1)
 F400I-228
 F162I-203 (MSL3997-1)
 F400I-215
 F400I-229
 F400I-230
 F400I-312
 VALVE TAPPETS

Valves, intake-rotor
 Valves, exhaust-rotor
 Inserts, valve seat (exhaust)
 Valve stem cap
 Valve spring seat
 Valve spring retainer lock (rotor)
 Valve spring
 Valve stem guide (exhaust)
 Valve stem guide (intake)
 Valve kit, intake & exhaust (engine set)

8A-b

F218I-2030

Valve tappet assembly
 Composed of:
 1 F218I-203 Tappet
 1 F600I-253 Nut

4
 4
 4
 8
 8
 16
 8
 4
 4

FS162-6055

9A-b

VALVE TAPPET CHAMBER COVER

VALVE COVER SECTION 9

F400A-3960

Cover assembly, valve tappet chamber
Composed of: *Not serviced separately

*1 F400A-396

Cover

*1 F400A-299

Tube

*1 F400A-244

Baffle

Stud, valve tappet chamber cover to cylinder 1/4-20 x 1-3/8

Nut, valve tappet chamber cover to cylinder stud

Gasket, valve tappet chamber cover to cylinder stud 7/16

Gasket, valve tappet chamber cover to cylinder

Valve grind gas&t kit

FL62U-109

F600A-3990

B9f5Le - tappet chamber drain - front & rear

1

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2

2

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2

FS162-6055

OIL PAN SECTION 10

10A-a

OIL PAN

FL45B-4010

✓ Oil pan assembly

Composed OF: * Not serviced separately

*1 FL45B-401

Oil pan

*2 F400B-311

Oil pan baffle

*1 F600B-317

Drain plug boss

*4 C400B-233

Reinforcement plates

1 W4B-109

Drain plug

1 W4B-108

Drain plug gasket

*2 F400B-331

Reinforcement plates (sides)

*1 F218B-200

Drain boss

Screw & lockwasher assembly 5/16-18 x 3/4, oil pan thru reinforcements

X-3896

F400B-442

X-104

FL24B -107

Gasket, oil pan & filler block

Pipe plug 3/4 ext. head, oil pan

Oil pan gasket kit

1

14

2

1

OIL PUMP

11A-a

F600L-41319

Pump assembly, oil

Composed OF:

- 1 F600L-4130 Body assembly
- 1 F400L-2511 280 Cover assembly
- 1 D600L-2120 Screen assembly
- 1 17EL-300 Frame
- 1 F218L-204 Shaft
- 1 F60CH-205 gear
- 1 F60CH-217 Gear
- 1 F60CH-218 Gear
- 1 8UL-212 Stud
- 1 D600L-204 Ring
- 1 C400L-228 Spacer
- 1 C400L-231 Gasket
- 1 17EL-204 Gasket
- 6 X-5798 Screw
- 1 X-17095 Pin
- 1 X-584 Key

Body assembly, oil pump

Composed OF: *Not serviced separately

*1 F600L-413 Body

1 D600G-274 Bushing

Stud, oil pump body to bearing cap 3/8-16 x 1-1/2

Nut, oil pump body to bearing cap stud 3/8-16

Washer, lock, oil pump body to bearing cap stud 3/8

Bushing, oil pump drive shaft (in crankcase)

Cover assembly, oil pump

Composed OF: *Not serviced separately

*1 F400L-251 Cover

*1 103H-204 Tube

Screen assembly, strainer oil pump

Composed OF: *Not serviced separately

*1 D600L-212 Screen

*1 6VB-119 Wire

Oil pump repair kit

F600L-4130

X-20040

X-1802-G

X-203

F400L-210

F400L-2711

D600L-2120

F600T-293

FSL62-6055

OIL CONTROL SECTION 13

13A-a OIL FILLER

D600L-2270

Cap assembly, oil filler
Composed OF: *Not serviced separately
*1 D600L-227 Cap
*1 D600L-228 Baffle
*1 C400L-242 Seal
*2 X-14175 Washers
Tube, oil filler

1

X-12210

1

13A-b OIL GAUGE ROD

F140L-3330

Rod assembly, oil gauge
Composed OF: *Not serviced separately
*1 F140L-333 Rod
*1 K404L-209 Cover
1 K404L-210 Felt
Support, oil gauge rod

1

Y400L-266

1

13A-d OIL PRESSURE RELIEF VALVE

15SL-211

Valve, relief, oil pressure
Spring, oil pressure relief valve
Washer, adjusting, oil pressure relief valve
Plug, oil pressure relief valve
Gasket, oil pressure relief valve plug

F400L-223

X-14324

41AL-200

X-365

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14A-a OIL FILTER

Y69L-4070	Oil filter - Fram F3 - POE #8133 (Element # F140L-336)	1
X-12887	Elbow 1/4 pipe x 1/2-20 thd. x 5/16 tube, crankcase oil outlet to oil filter	1
X-12539	Sr. conn 1/8 pipe x 1/2-20 thd. x 5/16 tube, governor oil inlet from oil filter	1
X-12015	Elbow 1/8 pipe x 1/2-20 thd. x 5/16 tube 90 degree, oil filter inlet	2
F162L-3420	1 - outlet - bottom Tube assembly Composed of: 1 - F162L-342 Tube 5/16 OD stud 2 - X-12008 Nut 1/2-20 thd. x 5/16 tube 1 Crankcase oil outlet to oil filter inlet side Tube assembly Composed of: 1 - F162L-409 Tube 5/16 OD steel 2 - X-12008 Nut 1/2-20 thd. x 5/16 tube	1
F162L-4090	Oil filter outlet - bottom - to governor top Screw 5/16-18 x 3/4, oil filter to bracket Washer - plain, oil filter bracket screw Washer - lock, 5/16, oil filter bracket screw Nut 5/16 - 18 x 17/64, oil filter bracket screw Bracket - oil filter	4 4 4 4 4
X-3182	Nut - spacer - cylinder head to blk for bracket	1
X-14219	Washer - plain, spacer nut for bracket	2
X-202-B	Nut 3/8-16, spacer nut for oil filter bracket	2
X-1801-E		2
F162L-340		
F162M-211		
X-14323		
X-1802-G		

FS162-6055

FLYWHEEL SECTION 17

17A-a FLYWHEEL

162C-4270 4380

Flywheel assembly

Composed Of:

1 162C-4274 38 Flywheel

1 M600C-300 Ring gear

Bolt, flywheel to crankshaft

Nut, flywheel to crankshaft bolt 3/8-24

Washer, lock, flywheel to crankshaft bolt 3/8

X-5822

X-18237

X-297

17A-b HOUSING - FLYWHEEL

162B-440

X-6767

C400B-226

X-3362

X-204

X-3043-A

8FC-205

6AB-107

X-203

Flywheel housing SAE #4 (3-1/8 deep)

Dowel 3/8-16 thd. x 3/8 OD x 1-1/8 lg., flywheel housing - rear face at two o'clock position

Dowel screw 7/16-14 x 1-1/2 lg., flywheel housing to crankcase

Screw 7/16-14 x 1-1/4 lg., flywheel housing to crankcase

Lockwasher 7/16, flywheel housing to crankcase

Flywheel pointer (drive screw)

Flywheel pointer cover

Screw 3/8-16 x 5/8 lg., flywheel pointer cover to housing

Lockwasher 3/8, flywheel pointer cover to housing

1

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6

6

1

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FS162 - 6055

STARTING CRANK

SECTION 19

19A-a

CRANK

PF162 - 3113

Starting crank

1

MANIFOLD AND MUFFLER SECTION 20

20A-b

INTAKE & EXHAUST MANIFOLD

F162E-508	Manifold, intake and exhaust	
X-4200	Stud, intake and exhaust manifold to cyl. 3/8-16 x 1-11/16	1
X-4256	Stud, intake & exhaust manifold to cyl. 3/8-16 x 3-5/8 (center)	6
X-18278	Nut, intake & exhaust manifold to cyl. stud 3/8-16 (brass)	1
X-14141	Washer, intake and exhaust manifold to cylinder 13/34	7
F400E-303	Gasket, intake and exhaust manifold to cylinder	4
X-14323	Washer, plain, manifold to cylinder end and center	1
X-12552	Tee, primer 1/4 pipe x 1/8 tube, intake manifold - side rear of riser	3
X-12546	Elbow primer 1/4 pipe x 1/8 tube, intake manifold - side front of riser	1
X-8038 - 6-1/2	Tube 1/8 OD copper x 6-1/2" long., primer elbow to tee in side of intake manifold	1
X-8151-6	Tube, intake manifold riser to vacuum pick-up on carburetor automatic choke. 6" long	1
X-12233	Elbow, intake manifold - riser 1/8 pipe x 1/8 tube	1
X-12232	Nut, tube to elbow at intake manifold - riser 5/16-2 4 thd. x 1/8 tube	1
Y116E-200	Rain cap (incl: pin and chain) muffler outlet	1

21A-a

CARBURETOR

F162F-465	Carburetor - Marvel TSX 826 (incl:12 volt, auto choke and Manual choke)	1
X-19982	Stud 5/16-18 x 1-7/8 lg., intake manifold to carburetor	2
F124F-240	Gasket 1" SAE - Aluminum - carburetor to intake manifold	1
X-297-A	Lockwasher 5/16, stud - intake manifold to carburetor	2
X-1801-E	Nut 5/16-18 x 17/64 hi., stud - intake manifold to carburetor	2
X-7566	Choke control	1
Y116M-310	Throttle control	1
X-297	Lockwasher 3/8, throttle control	1
X-18180	Nut 3/8-24 x 3/16 hi., throttle control	1

FS162-6055

FUEL PUMP SECTION 22

22A-a FUEL PUMP

X-12531 C143F-401
X-12530
X-12015
F400F-3490

Fuel pump - A.C. #1430837 1539837
- Elbow 1/8 pipe x 1/2-20 thd. x 5/16 tube 45°, fuel pump outlet
- Elbow 1/8 pipe x 1/2-20 thd. x 5/16 tube 90°, carburetor fuel inlet
- Tube assembly
Composed of:
1 F400F-349 Tube 5/16"
2 X-12008 Nut 1/2-20 thd. x 5/16 tube
Fuel pump outlet to carburetor inlet

1
1
1
1
1

FS162 - 6055

AIR CLEANER SECTION 23

23A-a

AIR CLEANER

Y112F-201
Y112F-202
F400F-352
X-2463
X-2364

Air cleaner - Vortox #S60
Saddle bracket - Vortox #6095, air cleaner
Hose 1-5/8 x 2ID x 32" lg., air cleaner to carburetor
Hose clamp ; air cleaner hose at carburetor
Hose clamp 2-3/8 ID, 2" air cleaner hose at air cleaner

1
1
1
1
1

FS162-6055

FUEL FILTER & PRIMER PUMP SECTION 24

24A-a FUEL FILTER

F400F-448

✓Fuel filter - A.C. #1595229

1

24A-b PRIMER PUMP

P244P-417
X-12946

✓Pump - Primer Dole #PR-7669

1
1

✓Fitting 5/16-24 thd. x 1/8 thd., primer pump outlet to primer tee at intake manifold - top

✓Fitting 3/8-27 thd. x 3/16 tube, primer pump inlet from fuel filter

1

X-12945

25A-a

GOVERNOR

F162S-5020	Governor - Hoof #	1
F140M-232	Gasket, governor to gear cover	1
X-5771	Screw & lockwasher assy., 3/8-16 x 1-1/8" lg., governor to gear cover lower	1
X-3284	Screw 3/8-16 x 3-3/8 lg., governor thru flange plate, gasket, gear cover and front end plate to magneto - upper	1
F400S-202	Gasket - flange, screw, governor to gear cover - upper	1
F400S-201	Plate - flange gasket, screw - governor to gear cover - upper	1
X-14134	Washer copper 3/8, screw governor to gear cover - upper	1
13XX-5692	Control rod 1/4-28 thd., governor to carburetor lever	1
X-12218	Ball joint 1/4-28 thd., governor lever	1
X-12313	Ball joint 1/4-28 thd., carburetor lever	1
13XX-201	Lockwasher 1/4	2
	1 - Ball joint to governor lever	
	1 - Ball joint to carburetor lever	
13XX-18137	Nut 1/4-28 x 7/32 hi.	3
	1 - Ball joint to governor lever	
	2 - Ball joint lock to control rod	

FS162-6055

WATER PUMP

SECTION 26

26A-a

WATER PUMP

F162K-3409

Pump assembly, water - complete

Composed of:

- 1 - F400K-420
- 1 - F226K-2230
- 1 - F401K-211
- 1 - OA200K-3040
- 1 - X-7096
- 1 - F400K-291
- 4 - X-3794
- 1 - F162K-338
- 1 - F162K-339
- 1 - X-7022
- 1 - K600K-220
- 1 - F400K-389
- 1 - X-3250
- 1 - X-203

- Body
- Shaft
- Impeller
- Seal
- Retainer
- Water shedder
- Screw
- Water pump cover
- Water pump cover gasket
- Bearing seat ring
- Gasket
- Fan hub
- Screw
- Lockwasher

F600K-371

Gasket, water pump to crankcase

X-5036

Connecting water pump body

X-3939

Screw 3/8-16 x 2-1/4, water pump to cyl. & crankcase - lower center

X-14134

Washer, plain, water pump to cylinder 3/8 - lower center

X-3979

Screw & lockwasher assy.; 3/8-16 x 1-1/4, water pump to crankcase.

X-5916

Screw & lockwasher, 3/8-16 x 1-7/8 - water pump to crankcase

F400T-335

Water pump repair kit

1

1 1 1 1 1 1 1

FS162-6055

FAN SECTION 27

27A-a FAN

F600K-366

✓ Fan blade 17" dia - 4 blade (pusher type)

1

27A-d FAN DRIVE PULLEY & BELT

FL40K-302

Pulley, fan drive (on crankshaft)

1

X-534

Key, fan drive pulley to crankshaft (Morton Hi Pro #HP-808)

1

C400K-217

Plug, keyway, fan drive pulley

1

Y69K-237

✓ Belt, fan, generator & water pump drive

1

WATER DISTRIBUTION SECTION 28

FS162-6055

28A-a CYLINDER WATER CONNECTIONS

F244X-308	✓ Elbow, outlet, cylinder water	1
X-19837	Stud, cylinder water outlet elbow to head 5/16-18 x 2-1/8	2
X-1801-E	Nut, cylinder water outlet elbow to head stud 5/16-18	2
X-202	Washer, lock, cylinder water outlet elbow to head stud 5/16	2
C400K-215	Gasket, cylinder water outlet elbow to head	1
X-5035	Connection, cylinder water outlet elbow	4
F400K-2940	✓ Recirc. tubes assembly	1
X-1021	✓ Drain cock: 3/8 pipe x 5/8 OD - crkcase water drain	1
THERMOSTAT		

28A-b

CD157K-204	Thermostat	1
F218K-202	Thermostat adapter ring	1
X-5695	Coolant conditioner (capsule)	1

FSL62-6055

IGNITION SECTION 30

30A-a MAGNETO

FL62M-448
FL70M-232
D60CH-287
Y69M-251
Y69M-244
Y69M-245
L3XX-4188
L3XX-14327
L3XX-14215
L3XX-18108

✓ Magneto - FIVE4B16W - 200
Governor & magneto fasket, magneto to front end plate
Rubber grommet, grommet supt.
Supt. ignition cable grommet, gear cover
✓ Supt. ignition cable grommet, R.H. front corner cylinder head
✓ Supt. ignition cable grommet, cylinder stud 3rd from rear center row
Stud 3/8-16 x 1-5/16 hi., magneto thru front end plate to gear cover
Plain washer 3/8, magneto thru front end plate to gear cover
Lockwasher 3/8, magneto to gear cover - lower
Nut 3/8-16 x 3/16 hi., stud magneto thru front end plate to gear cover
lower

1
1
3
1
1
1
1
1
1
2
2
1

30A-b SPARK PLUGS

SP205-BR8S)
SP205-XE8S)
XEDIC

opt.

✓ Spark plug - A.D. #BR8
✓ Spark plug - Champ #XESS XEDIC

4

FS162-6055

GENERATOR & STARTING MOTOR SECTION 31

31A-a GENERATOR

HD26CM-410
 F162M-378
 13XX-19002
 13XX-14215
 13XX-1802-G
 13XX-3246
 13XX-14327
 13XX-14290
 13XX-18203
 F162M-280
 13XX-3942
 13XX-14215
 13XX-3777
 F400M-217
 13XX-14290

- Generator - A.L. #GHP-6002AT-1 (24 volt. 18 amp. Neg. Grd.) (incl: pulley - fan & baffle)
- ✓ Bracket, generator
- ✓ Stud 3/8-16 x 1-1/4" lg., generator bracket to crankcase
- ✓ Lockwasher 3/8, stud generator bracket to crankcase
- ✓ Nut 3/8-16 x 21/64 hi., stud generator bracket to crankcase
- ✓ Screw 5/16-24 x 1-1/4 lg., generator to bracket
- ✓ Washer, plain, spacer, generator to bracket - rear
- ✓ Lockwasher 5/16, screw generator to bracket
- ✓ Nut 5/16-24 x 17/64 hi., screw generator to bracket
- ✓ Strap, generator adjusting
- ✓ Screw 3/8-16 x 1" lg., generator adjusting strap to water pump
- ✓ Lockwasher 3/8, screw generator adjusting strap to water pump
- ✓ Screw 5/16-18 x 7/8 lg., generator adjusting strap to generator
- ✓ Clip 11/32 ID, screw generator adjusting strap to generator
- ✓ Lockwasher 5/16, screw generator adjusting strap to generator

1
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 4
 4 3 2
 7 5 2
 2
 1
 2
 2
 1
 1
 1
 1
 1
 1
 2

31A-b STARTING MOTOR

F162M-457
 X-2979 X-5793
 B600M-348

MDZ-6001-T

- ✓ Starter - A.D. #30-1621F (solenoid engaged - 24 volt. enclosed solenoid)
- ✓ Screw & lockwasher assy. 3/8-16 x 2-1/4" lg., starter to flywheel housing
- ✓ Spacer, starter to flywheel housing

1
 3
 1

32A-a WIRES

RW384-29	Radio shielded hi. tens. lead assy., 29" lg., magneto to #1 spark plug	1
RW384-31	Radio shielded hi. tens. lead assy., 31" lg., magneto to #2 spark plug	1
RW384-38	Radio shielded hi tens. lead assy., 38" lg., magneto to #3 spark plug	1
RW384-40	Radio shielded hi. tens. lead assy., 40" lg., magneto to #4 spark plug	1
X-5620	Clip (5mm cable) screw - water pump to crankcase - manifold side (ground high tens. leads)	1
13XX-3250	Screw 3/8-16 x 1-7/8 lg., clip thru water pump body to crankcase - manifold side	1
13XX-14215	Lockwasher 3/8, screw clip thru water pump body to crankcase - manifold side	1
M363F-242	Resistor - 7x3 7.5 OHM	2
FS162T-104	Radio shielding kit (engine set)	

F400A-51317-S
CYLINDER & CRANKCASE ASSY.
(SHORT ENGINE ASSY.)

Same as Sub-Assembly F400A-5131-S except:

ADD:

<u>PART NUMBER</u>	<u>PART NAME</u>	<u>QUANTITY</u>
F400A-51317-R	Cylinder & crankcase assy.	1
F145B-4011	Oil pan assembly	1
F400B-5221	Gear cover assembly	1
F162A-329	Cylinder head	1
K-20009	Stud: oil filter to cyl. head	2
F400B-255	Filter block to oil pan seal	2
K-6794	Screw & lockwasher	2
	2-Gear cover to frt. filler block	
K-5719	Screw & lockwasher: gear cover to crkcase	1
K-14220	Lockwasher: 1 Gear cover to crkcase	
	1 Gear cover to frt. end plate	
K-226	Lockwasher: 2 Gear cov. to crkcase	3
	1 Gear cov. to frt. end plate	
F162U-147	Service gasket set	1

OMIT:

F400A-5131-R	Cylinder & crankcase assy.	1
F400B-4529	Oil pan assembly	1
F400B-4141	Gear cover assembly	1
F162A-335	Cylinder head assembly	1
K-3236	Screw: oil filter to cyl. hd. plug	2
F400B-237	Filler block to oil pan cork	2
K-203	Lockwasher: gear cov. to fil. blk. screws	2
K-270	Lockwasher: gear cover screw	1
K-14134	Lockwasher: gen. brkt. stud hole plug screw	1
K-2276	Spark plug hole cover	4
K-5821	Screw: gear cov. to frt. fil. blk.	2
K-5771	Screw & lockwasher: gear cov. to cyl.	1
K-3940	Screw: gen. brkt. stud hole plug	1
K-3236	Screw: oil filter stud hole to crkcase	2
K-14192	Copper washer, oil filter stud hole to crkcase	2
F162U-129	Service gasket set	1

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CYLINDER & CRANKCASE SECTION 1

8-16-61
9-26-61
2-15-63
8-7-69

re-typed

1A-a

CYLINDER & CRANKCASE

F400A-51317-A

Cylinder & crankcase assembly (stripped)

Composed of: Cylinder and crankcase, caps, bearings, guides, inserts, support, screws, stud, plugs, pins, etc.

1

F400A-51317-C

Cylinder and crankcase assembly

Composed of:

"A" assembly plus pistons and rings

1

F400A-51317-I

Cylinder and crankcase assembly

Composed of:

"C" assembly plus complete valve mechanism

1

F400A-51317-S

Cylinder and crankcase assembly

Composed of:

"I" assembly plus connecting rods, crankshaft, camshaft, front end plate, gears, filler blocks, cylinder head, gaskets, gear cover assembly, oil pump assembly, oil pan assembly, studs, nuts, screws, washer, plugs, and lockwires

1

F162U-121

Service gasket set

1

1A-b CRANKSHAFT BEARING CAPS

F400B-368 Cap, bearing, crankshaft (front) 1
 F400B-367 Cap, bearing, crankshaft (center) 1
 F400B-366 Cap, bearing, crankshaft (rear) 1
 X-14294 Washer 3/8 x 1/8 between bearing cap and oil pump mounting lug 4
 X-2986 Screw, crankshaft bearing cap to cylinder 1/2-13 x 2-1/2 2
 X-3511 Washer, plain, crankshaft bearing cap to cylinder screw 1/2 6
 X-14455 Wire, lock, crankshaft bearing cap to cylinder screw (front & rear) 2
 6SH-100 Wire, lock, crankshaft bearing cap to cylinder screw (center) #19 x 10 1
 X-1333-B Wire, lock, crankshaft bearing cap to cylinder screw (center) #19x12 1

1A-c FILLER BLOCKS

D600B-340 Block, filler (front) 1
 X-3924 Screw, filler block to crankcase (front) 5/16-18 x 7/8 2
 X-297-A Washer, lock, filler block to crankcase screw 5/16 2
 F400B-255 Seal, filler block to oil pan (front) 1
 D600B-406 Block, filler (rear) 1
 X-2958 Screw, filler block to crankcase (rear) 5/16-18 x 2-5/8 2
 X-297-A Washer, lock, filler block to crankcase screw 5/16 2
 F400B-255 Seal, filler block to oil pan (rear) 1
 T427B-201 Seal, filler block to crankshaft (rear) 2
 X-5798 Screw & lockwasher assembly, filler block to flywheel housing 1/4-20 x 5/8 2

1A-d HOLES COVERS & PLUGS

X-1954-B Stud, fuel pump hole cover to cylinder 5/16-18 x 1-1/4 2
 X-1801-E Nut, fuel pump hole cover to cylinder stud 5/16-18 2
 X-202 Washer, lock, fuel pump hole cover to cylinder stud 5/16 2
 16EV-201 Gasket, fuel pump hole cover to cylinder 1 1
 X-3940 Screw, plugging, generator bracket stud hole 3/8-16 x 5/8 1
 X-14134 Washer, copper, generator bracket stud hole plugging screw 3/8 1
 X-2236 Plug, hubbard, camshaft bushing (rear) 1-1/2 1
 X-2207 Plug, hubbard, cylinder core hole 1-1/8 1
 X-2202 Plug, hubbard, cylinder core hole 1-3/8 1
 X-137-A Plug, pipe, crankcase oil header 1/4 (c/sunk special) 2

FSL62-6055

CYLINDERHEAD SECTION 2

2A-a

CYLINDER HEAD

F162A-329

X-19828

3XX-1803-E

3XX-1408

F400A-336

Head, cylinder

Stud, cylinder head to cylinder 7/16-20 x 3-15/32

Nut, cylinderhead cylinder stud 7/16-20

Washer, plain, cylinder head to cylinder stud 7/16

Gasket, cylinder head to cylinder

1
15
14
13
1

1/4" x 3 1/2" (My hole insert)

2A-b

CYLINDER HEAD PLUGS

X-3940

X-14134

X-2538

X-101-B

X-104

Screw, plugging, distributor adapter stud hole 3/8-16 x 5/8

Washer, copper, distributor adapter stud hole plugging screw 3/8

Plug, special, distributor drive hole

Plug, pipe, cylinder head thermometer hole 1/2 (c'sunk)

Plug, pipe ext. head 3/4 cylinder head-top rear

1
1
1
1
1
1

2A-c

LIFTING EYE

F162A-258

F40A-210

Motor lifting eye 7/16-20 thd. cylinder head to crankcase-near center

1

FS163-6055

CRANKSHAFT SECTION 3

3A-a CRANKSHAFT

F400C-503
F600C-205
A500C-204
F600-O-206
F600-O-205

Crankshaft
Plate, thrust, crankshaft
Crankshaft oil thrower
Crankshaft starting jaw
Crankshaft starting jaw washer

1
1
1
1
1
1

3A-b CRANKSHAFT BEARINGS

F162G-300 (MSL3974-1)
F162G-204 (MSL3987-1)

Crankshaft bearing, front, upper and lower
Crankshaft bearing, center, rear, upper and lower

2
4

Bearing available in standard only

FSL62-6055

CONNECTING ROD SECTION 4

4A-a

CONNECTING RODS

F218D-3021

Rod assembly, connecting (cylinder 1 & 3)
Composed of: *Not serviced separately
*1 F218D-3020 Rod & cap
2 F162G-202 Bushing
2 C600D-206 Bolts
2 X-18188 Nuts

2

F218D-3031

Rod assembly, connecting (cylinder 2 & 4)
Composed of: *Not serviced separately
*1 F218D-3030 Rod & cap
2 F162G-202 Bushings
2 C600D-206 Bolts
2 X-18188 Nuts

2

X-601

Cotter pin, connecting rod bolts

8

4A-b

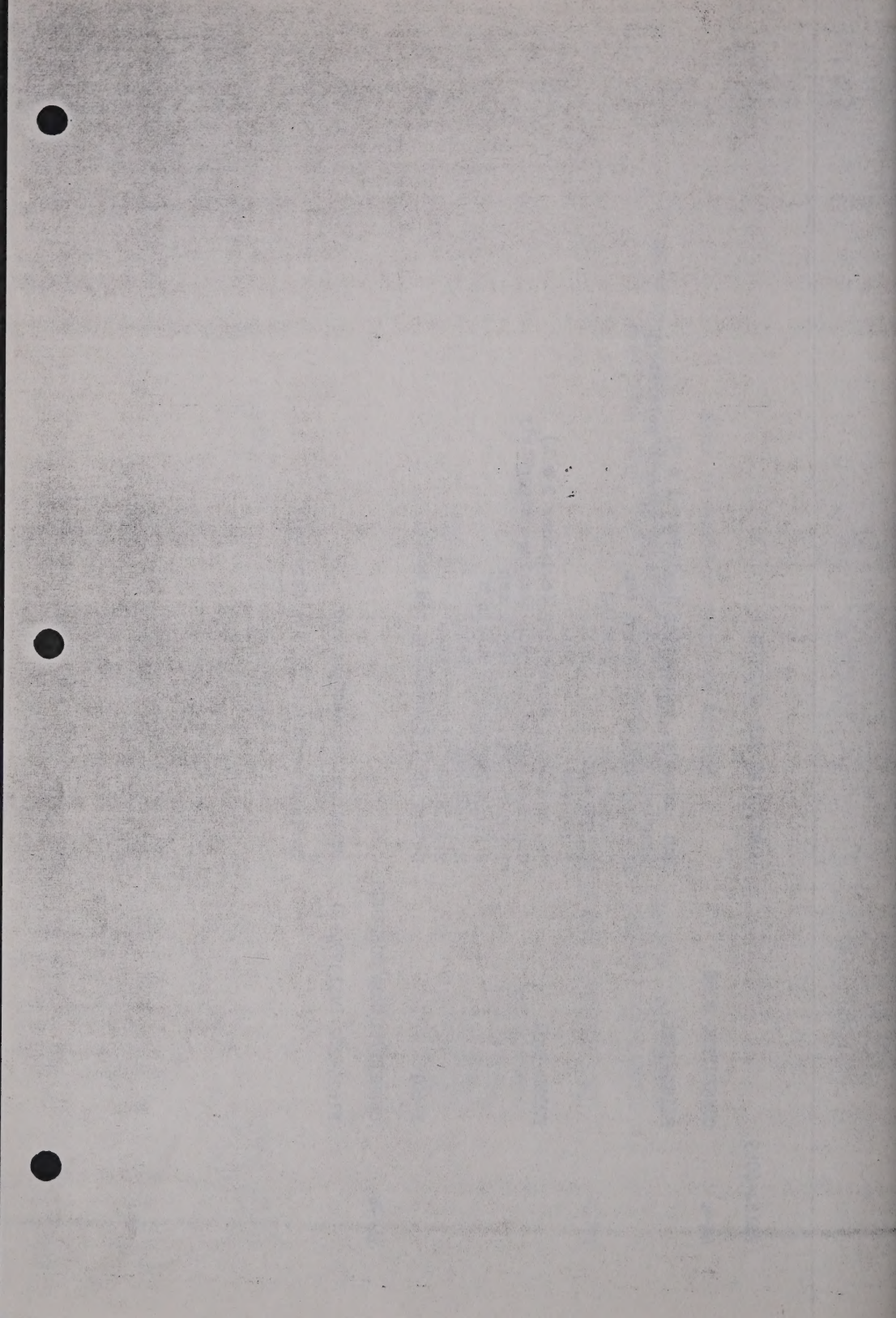
CONNECTING ROD BUSHINGS

F162G-202 (MSL3994-1)

Bushings, connecting rod

8

Bearings available in standard only



FS162-6055

PISTON SECTION 5

5A-a

PISTON

FL62A-4171-A

Piston assembly (complete)

Composed of:

1 FL62A-417

1 FL62A-230

2 FL62A-229

1 FL62A-231

1 FL62A-232

2 FL62A-233

Piston assembly

Composed of:

1 FL62A-417

1 FL62A-230

2 FL62A-229

Piston (MS13957-1)

Piston pin (MS13996-2)

retaining ring (MS13962-1)

Piston ring-top groove-chrome (MS13933-7)

Piston ring-2nd groove (MS13932-7)

Piston ring-3rd & 4th groove (MS13931-7)

Piston

Pin

Ring

5A-c

PISTON PIN BUSHING

FL62C-203 MS13963-1)

Piston pin bushing

Pistons and rings available in std., .020 and .040 O.S. only

FS162-6055

CAMSHAFT SECTION 6

6A-a

CAMSHAFT

F400I-421
Y400I-203
X-3897

Camshaft

Plate, thrust, camshaft

Screw & lockwasher, camshaft thrust plate to crankcase 5/16-18 x 5/8

1
1
1

6A-b

CAMSHAFT BUSHINGS

*F600G-295
F*Y400G-228
**Y400G-229
**Production bushings service bushings finish reamed available in kit #F400T-181

Bushing, camshaft (front) F226G-227 Service bushing
Bushing, camshaft (center) Y400G-231 service bushing
Bushing, camshaft (rear) Y400G-232 Service bushing

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6A-c

TIMING GEARS

F400H-401
X-506
~~X-18156~~
~~P4C-202~~
D600H-300
X-534

Gear, timing camshaft
Key, crankshaft timing gear to camshaft (WOODRUFF #6)
Nut, camshaft timing gear to camshaft 7/8-18 (Elastics)
~~Lock, nut, camshaft timing gear to camshaft nut~~
Gear, timing crankshaft
Key, crankshaft timing, gear to crankshaft (Morton Hi-Pro #HP-808)

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X-18498

7A-a GE. R COVER

F400B-5221

✓ Cover assembly, gear 1

Composed of: *Not serviced separately

*1 F400B-522 Cover

1 X-1555 Seal

1 F400B-383 Gasket

Ring dowel, gear cover to crankcase

Screw 7/16-14 x 1-1/2, gear cover to crankcase

✓ Screw & lockwasher assembly 3/8-16 x 2, gear cover to front filler block

Screw Hex Head 3/8-16 x 2, gear cover to front filler block

Copper washer, gear cover to filler block screws

✓ Lockwasher 3/8

2-Gear cover to cylinder

✓ 1-Gear cover to front end plate

✓ Screw & lockwasher assembly 3/8-16 x 1-1/8, gear cover to cylinder block

Screw hex 3/8-16 x 1-1/8

1-Gear cover to end plate

1-Gear cover to filler block

Screw & lockwasher assembly, gear cover to end plate

Stud 3/8-16 x 1-11/16, gear cover to cylinder upper holes

Nut 7/16-14, Gear cover dowel screw

Nut 3/8-16

2-Gear cover to cylinder

1-Gear cover to end plate

✓ Washer 7/16, lock

✓ 1-Gear cover to front end plate

✓ 1-Gear cover to crankcase

X-14220

7A-b

FRONT END PLATE

F400B-365

D600B-203

X-3386

X-3896

F400B-225

X-270

Front end plate

Ring dowel, front end plate

Screw, front end plate to crankcase

Screw & lockwasher assembly 5/16-18 x 3/4, front end plate to crankcase

Gasket, front end plate to crankcase

Washer 7/16 lock, front end plate to crankcase

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FSL62-6055

VALVE SECTION 8

8A-a

VALVES & ASSOCIATED PARTS

F162I-201 (MSL3999-8) Valves, intake-rotor
F162I-202 (MSL3999-3) Valves, exhaust-rotor
F400I-288 Inserts, valve seat (exhaust)
F162I-204 (MSL3998-1) Valve stem cap
F400I-228 Valve spring seat
F162I-203 (MSL3997-1) Valve spring retainer lock (rotor)
Y400I-215 Valve spring
F400I-229 Valve stem guide (exhaust)
F400I-230 Valve stem guide (intake)
F400I-312 Valve kit, intake & exhaust (engine set)

8A-b

VALVE TAPPETS

F218I-2030

Valve tappet assembly

Composed of:

1 F218I-203 Tappet
1 F600I-253 Nut

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16
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8

FS162-6055

VALVE COVER SECTION 9

9A-b

VALVE TAPPET CHAMBER COVER

F400A-3960

Cover assembly, valve tappet chamber

Composed of: *Not serviced separately

*1 F400A-396

Cover

*1 F400A-299

Tube

*1 F400A-244

Baffle

Stud, valve tappet chamber cover to cylinder 1/4-20 x 1-3/8

X-4036

X-18327

X-334

FL24A-201

Nut, valve tappet chamber cover to cylinder stud

Gasket, valve tappet chamber cover to cylinder stud 7/16

Gasket, valve tappet chamber cover to cylinder

FL62U-109

Valve grind gasket kit

F600A-3990

Baffle-tappet chamber drain-front & rear

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PS162-6055

OIL PAN SECTION 10

10A-a OIL PAN

FL45B-4010

Oil pan assembly

Composed of:

* Not serviced separately

*1 FL45B-401

Oil pan

*2 F400B-311

Oil pan baffle

*1 F600B-317

Drain plug boss

*4 C400B-233

Reinforcement plates

1 W4B-109

Drain plug

1 W4B-108

Drain plug gasket

*2 F400B-331

Reinforcement plates (sides)

*1 F218B-200

Drain boss

X-3896

Screw & lockwasher assembly 5/16-18 x 3/4, oil pan thru reinforcements

to crankcase

Gasket, oil pan & filler block

Pipe plug 3/4 ext. head, oil pan

Oil pan gasket kit

F400B-442

X-104

FL24H -107

1

14

2

1

11A-a OIL PUMP

F600L-41319

Pump assembly, oil

Composed OF:

- 1 F600L-4130 Body assembly
- 1 F400L-211 Cover assembly
- 1 D600L-2120 Screen assembly
- 1 17EL-300 Frame
- 1 F218L-204 Shaft
- 1 F600H-205 gear
- 1 F600H-217 Gear
- 1 F600H-218 Gear
- 1 8UL-212 Stud
- 1 D600L-204 Ring
- 1 C400L-228 Spacer
- 1 C400L-231 Gasket
- 1 17EL-204 Gasket
- 6 X-5798 Screw
- 1 X-17095 Pin
- 1 X-584 Key

F600L-4130

Body assembly, oil pump

Composed OF:

- *1 F600L-413 Body
- 1 D600G-274 Bushing
- Stud, oil pump body to bearing cap 3/8-16 x 1-1/2
- Nut, oil pump body to bearing cap stud 3/8-16
- Washer, lock, oil pump body to bearing cap stud 3/8
- Bushing, oil pump drive shaft (in crankcase)

F400L-210

Cover assembly, oil pump

Composed OF: *Not serviced separately-

- *1 F400L-251 Cover

*1 16SL-204 Tube

D600L-2120

Screen assembly, strainer oil pump

Composed OF:

- *1 D600L-212 Screen
- *1 6VB-119 Wire

Oil pump repair kit

F600T-293

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FS162-6055

OIL CONTROL SECTION 13

13A-a OIL FILLER

D600L-2270

Cap assembly, oil filler
Composed OF: *Not serviced separately
*1 D600L-227 Cap
*1 D600L-228 Baffle
*1 C400L-242 Seal
*2 X-14175 Washers
Tube, oil filler

1

X-12210

1

13A-b OIL GAUGE ROD

FL40L-3330

Rod assembly, oil gauge
Composed OF: *Not serviced separately
*1 FL40L-333 Rod
*1 K404L-209 Cover
1 K404L-210 Felt
Support, oil gauge rod

1

Y400L-266

1

13A-d OIL PRESSURE RELIEF VALVE

15SL-211
F400L-223
X-14324
41AL-200
X-365

Valve, relief, oil pressure
Spring, oil pressure relief valve
Washer, adjusting, oil pressure relief valve
Plug, oil pressure relief valve
Gasket, oil pressure relief valve plug

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14A-a

OIL FILTER

Y69L-4070	Oil filter - Fram F3 - POE #8133 (Element # F140L-336)	1
X-12887	Elbow 1/4 pipe x 1/2-20 thd. x 5/16 tube, crankcase oil outlet to oil filter	1
X-12539	Str. conn 1/8 pipe x 1/2-20 thd. x 5/16 tube, governor oil inlet from oil filter	1
X-12015	Elbow 1/8 pipe x 1/2-20 thd. x 5/16 tube 90 degree, oil filter inlet	2
F162L-3420	1 - outlet - bottom Tube assembly Composed of: 1 - F162L-342 2 - X-12008 1 Crankcase oil outlet to oil filter inlet side Tube assembly Composed of: 1 - F162L-409 2 - X-12008 Tube 5/16 OD steel Nut 1/2-20 thd. x 5/16 tube	1
F162L-4090	Oil filter outlet - bottom - to governor top Screw 5/16-18 x 3/4, oil filter to bracket Washer - plain, oil filter bracket screw Washer - lock, 5/16, oil filter bracket screw Nut 5/16 - 18 x 17/64, oil filter bracket screw Bracket - oil filter Nut - spacer - cylinder head to blk for bracket Washer - plain, spacer nut for bracket Nut 3/8-16, spacer nut for oil filter bracket	1
X-3182		4
X-14219		4
X-202-B		4
X-1801-E		4
F162L-340		1
F162M-211		2
X-14323		2
X-1802-G		2

FSL62-6055

FLYWHEEL SECTION 17

17A-a FLYWHEEL

F162C-4370 4380

Flywheel assembly

Composed OF:

1 F162C-4374 38 Flywheel

1 M600C-300 Ring gear

X-5822

X-18237

X-297

Bolt, flywheel to crankshaft

Nut, flywheel to crankshaft bolt 3/8-24

Washer, lock, flywheel to crankshaft bolt 3/8

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6

6

6

17A-b HOUSING - FLYWHEEL

F162B-440

X-6767

Flywheel housing SAE #4 (3-1/8 deep)

Dowel 3/8-16 thd. x 3/8 OD x 1-1/8 lg., flywheel housing - rear face at two o'clock position

1

1

C400B-226

X-3362

X-204

X-3043-A

8FC-205

6AB-107

X-203

Dowel screw 7/16-14 x 1-1/2 lg., flywheel housing to crankcase

Screw 7/16-14 x 1-1/4 lg., flywheel housing to crankcase

Lockwasher 7/16, flywheel housing to crankcase

Flywheel pointer (drive screw)

Flywheel pointer cover

Screw 3/8-16 x 5/8 lg., flywheel pointer cover to housing

Lockwasher 3/8, flywheel pointer cover to housing

2

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4

FS162 - 6055

STARTING CRANK

SECTION 19

19A-a

CRANK

PF162 - 3113

Starting crank

1

20A-b

INTAKE & EXHAUST MANIFOLD

F162E-508

Manifold, intake and exhaust

X-4200

Stud, intake and exhaust manifold to cyl. 3/8-16 x 1-11/16

X-4256

Stud, intake & exhaust manifold to cyl. 3/8-16 x 3-5/8 (center)

X-18278

Nut, intake & exhaust manifold to cyl. stud 3/8-16 (brass)

X-14141

Washer, intake and exhaust manifold to cylinder 13/34

F400E-303

Gasket, intake and exhaust manifold to cylinder

X-14323

Washer, plain, manifold to cylinder end and center

X-12552

Tee - primer 1/4 pipe x 1/8 tube, intake manifold - side rear of riser

X-12546

Elbow primer 1/4 pipe x 1/8 tube, intake manifold - side front of riser

X-8038 - 6-1/2

Tube 1/8 OD copper x 6-1/2" long., primer elbow to tee in side of intake manifold

X-8151-6

Tube, intake manifold riser to vacuum pick-up on carburetor automatic

chke. 6" long

X-12233

Elbow, intake manifold - riser 1/8 pipe x 1/8 tube

X-12232

Nut, tube to elbow at intake manifold - riser 5/16-2 4 thd. x 1/8 tube

Y116E-200

Rain cap (incl: pin and chain) muffler outlet

21A-a

CARBURETOR

F162F-465	Carburetor - Marvel TSX 826 (incl:12 volt, auto choke and Manual choke)	1
X-19982	Stud 5/16-18 x 1-7/8 lg., intake manifold to carburetor	2
F124F-240	Gasket 1" SAE - Aluminum - carburetor to intake manifold	1
X-297-A	Lockwasher 5/16, stud - intake manifold to carburetor	2
X-1801-E	Nut 5/16-18 x 17/64 hi., stud - intake manifold to carburetor	2
X-7566	Choke control	1
Y116M-310	Throttle control	1
X-297	Lockwasher 3/8, throttle control	1
X-18180	Nut 3/8-24 x 3/16 hi., throttle control	1

F8162-6055

FUEL PUMP SECTION 22

22A-a FUEL PUMP

C143F-401

~~X-12539~~

X-12015

F400F-3490

Fuel pump - A.C. #1639837 1539837

- Elbow 1/8 pipe x 1/2-20 thd. x 5/16 tube 45°, fuel pump outlet

- Elbow 1/8 pipe x 1/2-20 thd. x 5/16 tube 90°, carburetor fuel inlet

- Tube assembly

Composed OF:

1 F400F-349

2 X-12008

Fuel pump outlet to carburetor inlet

Tube 5/16"

Nut 1/2-20 thd. x 5/16 tube

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23A-a

AIR CLEANER

Y112F-201
Y112F-202
F400F-352
X-2463
X-2364

Air cleaner - Vortex #S60
Saddle bracket - Vortex #6095, air cleaner
Hose 1-5/8 x 2ID x 32" lg., air cleaner to carburetor
Hose clamp, air cleaner hose at carburetor
Hose clamp 2-3/8 ID, 2" air cleaner hose at air cleaner

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FS162-6055

FUEL FILTER & PRIMER PUMP SECTION 24

24A-a FUEL FILTER

F400F-448

✓Fuel filter - A.C. #1595229

1

24A-b PRIMER PUMP

F244F-417

✓Pump - Primer Dole #PR-7669

1

X-12946

✓Fitting 5/16-24 thd. x 1/8 thd., primer pump outlet to primer tee at intake manifold - top

1

X-12945

✓Fitting 3/8-27 thd. x 3/16 tube, primer pump inlet from fuel filter

1

25A-a

GOVERNOR

F162S-5020	Governor - Hoof #	1
F140M-232	Gasket, governor to gear cover	1
X-5771	Screw & lockwasher assy., 3/8-16 x 1-1/8" lg., governor to gear cover lower	1
X-3284	Screw 3/8-16 x 3-3/8 lg., governor thru flange plate, gasket, gear cover and front end plate to magneto - upper	1
F400S-202	Gasket - flange, screw, governor to gear cover - upper	1
F400S-201	Plate - flange gasket, screw - governor to gear cover - upper	1
X-14134	Washer copper 3/8, screw governor to gear cover - upper	1
13XX-5692	Control rod 1/4-28 thd., governor to carburetor lever	1
X-12218	Ball joint 1/4-28 thd., governor lever	1
X-12313	Ball joint 1/4-28 thd., carburetor lever	1
13XX-201	Lockwasher 1/4	2
	1 - Ball joint to governor lever	
	1 - Ball joint to carburetor lever	

13XX-18137

Nut 1/4-28 x 7/32 hi.	3
1 - Ball joint to governor lever	
2 - Ball joint lock to control rod	

FS162-6055

WATER PUMP

SECTION 26

26A-a

WATER PUMP

F162K-3409

Pump assembly, water - complete

Composed of:

1 - F400K-420 Body

1 - F226K-2230 Shaft

1 - F401K-211 Impeller

1 - OA200K-3040 Seal

1 - X-7096 Retainer

1 - F400K-291 Water shedder

4 - X-3794 Screw

1 - F162K-338 Water pump cover

1 - F162K-339 Water pump cover gasket

1 - X-7022 Bearing seat ring

1 - K600K-220 Gasket

1 - F400K-389 Fan hub

1 - X-3250 Screw

1 - X-203 Lockwasher

F600K-371

Gasket, water pump to crankcase

Connecting water pump body

Screw 3/8-16 x 2-1/4, water pump to cyl. & crankcase - lower center

Washer, plain, water pump to cylinder 3/8 - lower center

Screw & lockwasher assy.; 3/8-16 x 1-1/4, water pump to crankcase.

Screw & lockwasher, 3/8-16 x 1-7/8 - water pump to crankcase

F400T-335

Water pump repair kit

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FS162-6055

FAN SECTION 27

27A-a FAN

F600K-366

✓ Fan blade 17" dia - 4 blade (pusher type)

1

27A-d FAN DRIVE PULLEY & BELT

FL40K-302

Pulley, fan drive (on crankshaft)

1

X-534

Key, fan drive pulley to crankshaft (Morton Hi Pro #HP-808)

1

C400K-217

Plug, keyway, fan drive pulley

1

Y69K-237

✓ Belt, fan, generator & water pump drive

1

FS162-6055

WATER DISTRIBUTION SECTION 28

28A-a CYLINDER WATER CONNECTIONS

F244K-308	✓ Elbow, outlet, cylinder water	1
X-19837	Stud, cylinder water outlet elbow to head 5/16-18 x 2-1/8	2
X-1801-E	Nut, cylinder water outlet elbow to head stud 5/16-18	2
X-202	Washer, lock, cylinder water outlet elbow to head stud 5/16	2
C400K-215	Gasket, cylinder water outlet elbow to head	1
X-5035	✓ Connection, cylinder water outlet elbow	4
F400K-2940	Recirc. tubes assembly	1
X-1021	✓ Drain cock: 3/8 pipe x 5/8 OD - crkcase water drain	1

28A-b THERMOSTAT

GD157K-204	Thermostat	1
F218K-202	Thermostat adapter ring	1
X-5695	Coolant conditioner (capsule)	1

FSL62-6055

IGNITION SECTION 30

30A-a

MAGNETO

FL62M-448
FL40M-232
D60CM-287
Y69M-251
Y69M-244
Y69M-245
13XX-4188
13XX-14327
13XX-14215
13XX-18108

✓ Magneto - FMXE4B16W - 200
Governor & magneto gasket, magneto to front end plate
Rubber grommet, grommet supt.
Supt. ignition cable grommet, gear cover
✓ Supt. ignition cable grommet, R.H. front corner cylinder head
Stud 3/8-16 x 1-5/16 lg., magneto thru front end plate to gear cover
Plain washer 3/8, magneto thru front end plate to gear cover
Lockwasher 3/8, magneto to gear cover - lower
Nut 3/8-16 x 3/16 hi., stud magneto thru front end plate to gear cover
lower

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30A-b

SPARK PLUGS

SP205-BR8S)
SP205-XES)
XED/C

opt.

✓ Spark plug - A.D. #BR8S
✓ Spark plug - Champ #XES XED/C

4

FSL62-6055

GENERATOR & STARTING MOTOR SECTION 31

31A-a

GENERATOR

- HD26CM-410
- F162M-378
- 13XX-19002
- 13XX-14215
- 13XX-1802-G
- 13XX-3246
- 13XX-14327
- 13XX-14290
- 13XX-18203
- F162M-280
- 13XX-3942
- 13XX-14215
- 13XX-3777
- F40CM-217
- 13XX-14290

- ✓ Generator - A.L. #GHP-6002AT-1 (24 volt. 18 amp. Neg. Grd.) (incl: pulley - fan & baffle)
- ✓ Bracket, generator
- ✓ Stud 3/8-16 x 1-1/4" lg., generator bracket to crankcase
- ✓ Lockwasher 3/8, stud generator bracket to crankcase
- ✓ Nut 3/8-16 x 2 1/64 hi., stud generator bracket to crankcase
- ✓ Screw 5/16-24 x 1-1/4 lg., generator to bracket
- ✓ Washer, plain, spacer, generator to bracket - rear
- ✓ Lockwasher 5/16, screw generator to bracket
- ✓ Nut 5/16-24 x 17/64 hi., screw generator to bracket
- ✓ Strap, generator adjusting
- ✓ Screw 3/8-16 x 1" lg., generator adjusting strap to water pump
- ✓ Lockwasher 3/8, screw generator adjusting strap to water pump
- ✓ Screw 5/16-18 x 7/8 lg., generator adjusting strap to generator
- ✓ Clip 11/32 ID, screw generator adjusting strap to generator
- ✓ Lockwasher 5/16, screw generator adjusting strap to generator

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31A-b

STARTING MOTOR

- F162M-457
- X-5977 X-5793
- B60CM-348

- ✓ Starter - A.D. #30-16314F (solenoid engaged - 24 volt. enclosed solenoid)
- ✓ Screw & lockwasher assy. 3/8-16 x 2-1/4" lg., starter to flywheel housing
- ✓ Spacer, starter to flywheel housing

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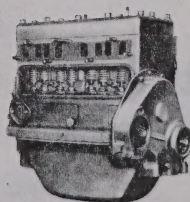
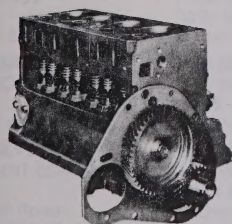
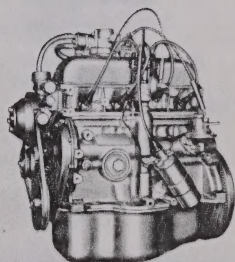
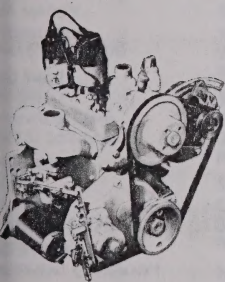
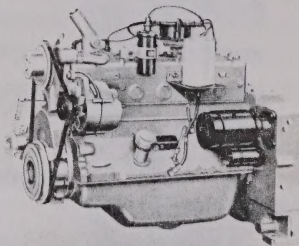
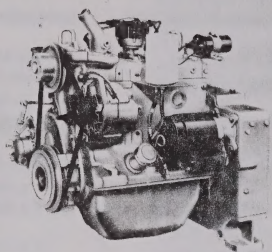
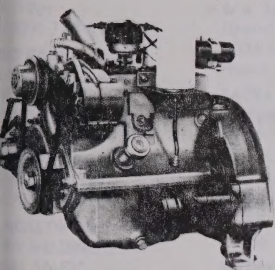
MDZ-6001-T

32A-a

WIRES

RW384-29	Radio shielded hi. tens. lead assy., 29" lg., magneto to #1 spark plug	1
RW384-31	Radio shielded hi. tens. lead assy., 31" lg., magneto to #2 spark plug	1
RW384-38	Radio shielded hi. tens. lead assy., 38" lg., magneto to #3 spark plug	1
RW384-40	Radio shielded hi. tens. lead assy., 40" lg., magneto to #4 spark plug	1
X-5620	Clip (5mm cable) screw - water pump to crankcase - manifold side	1
	(ground high tens. leads)	
13XX-3250	Screw 3/8-16 x 1-7/8 lg., clip thru water pump body to crankcase - manifold side	1
13XX-14215	Lockwasher 3/8, screw clip thru water pump body to crankcase - manifold side	1
M363F-242	Resistor - 7x5 7.5 OHM	2
FS162T-104	Radio shielding kit (engine set)	

Industrial Engine Warehouse Distributor/Dealer Directory



N GROVE 92113

A SERVICES
Dalberga
(714) 235-6309

BEACH 90807

SON-BEVIER CO., INC.
Cherry Avenue
(213) 424-9013

ANGELES 90023

HART ELECTRIC COMPANY
E. Olympic Boulevard
(213) 264-1521

ED 95340

AUTO PARTS*
W. 17th
(209) 722-4121

STO 95351

S MACHINE SHOP*
Hind
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H HOLLYWOOD 91605

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AND 94606

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AND 94621

AN-SPIKA*
Edgewater Drive
(415) 562-6667

AND 94608

ENGINE
San Pablo
(415) 655-0256

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EQUIPMENT COMPANY*
(h)
E. 5th Street
(714) 984-2291

ND 95963

LOUX BROS.*
Walker
(916) 865-4458

RD 93030

CE MACHINERY CO.*
Fraser
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SPRINGS 92262

EQUIPMENT COMPANY*
(h)
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ROBLES 93446

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46 East
(805) 238-4811

UMA 94952

UMA AUTO PARTS*
th Street
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URGH 94565

URGH MOTOR*
10th
(707) 432-4765

RED BLUFF 96080

TEHAMA AUTO PARTS*
1030 Main Street
Phone: (916) 527-4135

REDDING 96001

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1500 California
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BEARING SUPPLY CO.*
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GERLINGER MOTOR PARTS*
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LACEY AUTO PARTS*
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SAN BERNARDINO 92401

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Phone: (714) 889-8341

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BAY ELECTRIC WORKS**
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SAN DIEGO 92110

CONTRACTORS EQUIPMENT CO.*
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FORK LIFT PARTS OF SAN DIEGO*
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Phone: (714) 235-6437

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SAN DIEGO MACHINE CO.
1227 "J" Street
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SAN DIEGO 92120

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SAN DIEGO 92101

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SAN JOSE 95131

PENNIMAN & RICHARDS*
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SAN JOSE 95110

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JACOBSON MACHINE*
2nd & Lincoln
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WILSON & HARRINGTON*
126 Fern
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WALLACE MACHINERY CO.*
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SANTA ROSA 94572

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VALLEJO 94590

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1110 Colusa
Phone: (707) 643-2561

WATSONVILLE 95076

DAVIS AUTO PARTS*
245 Rodrigues
Phone: (408) 722-2722

WEST SACRAMENTO 95691

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COMPANY (Branch of
Sacramento)**
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Phone: (916) 371-0140

WILLOWS 95988

BARCELOUX BROS.*
124 S. Butte
Phone: (916) 934-4659

VICTORVILLE 92392

W.K. EQUIPMENT COMPANY*
(Branch)
14820 7th Street
Phone: (714) 245-6401

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Phone: (303) 892-1263

FORT LUPTON 80621

FORT LUPTON AUTO PARTS*
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Phone: (303) 825-1462

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ATOR ENGINE PARTS*
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TRUCK*
133 Belvidere Road
Phone: (312) 249-1440

WAUKEGAN 60085
PLACE MOTOR SUPPLY*
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WEST FRANKFURT 62896
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733 N. Capitol Avenue
Phone: (317) 634-6333

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CLARKLIFT OF INDIANA, INC.*
3155 N. Shadeland Avenue
Phone: (317) 545-6631

INDIANAPOLIS 46202
GODWIN COMPANY*
1175 West 16th Street
Phone: (317) 637-3325

INDIANAPOLIS 46268
KENNEY MACHINERY
CORPORATION*
(RENAULT ONLY)
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Phone: (317) 293-4793

INDIANAPOLIS 46241
LPM PARTS & SERVICE OF
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2321 Executive Drive
Phone: (317) 248-9411

INDIANAPOLIS 46204
MOTIVE PARTS COMPANY*
555 N. Capital Avenue
Phone: (317) 639-1333

INDIANAPOLIS 46241
RUDD CONSTRUCTION
EQUIPMENT CO.*
2655 Kentucky Avenue
Phone: (317) 247-9125

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STATE EQUIPMENT COMPANY*
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FRANK'S PISTON SERVICE, INC.
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MUNCIE 47302
B K MACHINE COMPANY**
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SEYMOUR AUTO GLASS
105 S. Broadway
Phone: (812) 522-2273

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EQUIPMENT CORPORATION*
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TERRE HAUTE 47806
JOHN S. COX & SON, INC.*
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Phone: (812) 234-5561

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(312) 721-5121

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141 W. Kelly Street
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Tom Starke, Service Manager

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P.O. Box 1
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INDIANAPOLIS 47421
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113 "K" Street
Phone: (812) 275-4424

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COLUMBUS AUTO SUPPLY, INC.*
105 S. 25th Street
Phone: (812) 372-3761

CHART 46514
ANGELO INDUSTRIAL ENGINE
BUILDING*
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C.*
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PORT WAYNE 46804
INDUSTRIAL TRUCK PARTS, INC.*
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Phone: (219) 744-3361

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LPM PARTS & SERVICE*
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Phone: (219) 484-6625

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LPM PARTS & SERVICE OF
NORTHERN INDIANA*
5525 Industrial Road
Phone: (219) 483-0568

FORT WAYNE 46803
MATERIALS HANDLING
EQUIPMENT CORP.*
7433 US 30 East
Phone: (219) 749-0475

FORT WAYNE 46826
SUMMIT POWER EQUIPMENT*
(RENAULT ONLY)
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Phone: (219) 484-2507

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EQUIPMENT CO., INC.*
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Joe Dicks, Parts Manager
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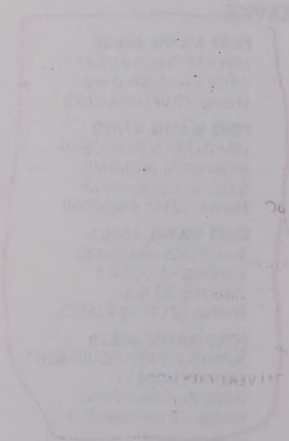
NEW WAREHOUSE BUILDINGS

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NEW WAREHOUSE BUILDINGS

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STN SUPPLY CO.
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M DOWN CO.**
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NY WILLIAMS*
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ny (606) 324-2195

BOWLING GREEN 42101
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407 Dishman
Phone: (502) 842-6539

HLAD 41101
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UENT COMPANY*
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ny (606) 325-8415

CALVERT CITY 42029
CALVERT CITY AUTO*
Phone: (502) 395-4104

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ICOUNTY AUTO PARTS
hvy 231 North
ny (502) 274-7144

CORBIN 40701
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FRANKFORT WOMWELL CO.
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NUNN AUTO SUPPLY
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Phone: (502) 651-2128

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WEIN AUTO & EQUIPMENT*
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Phone: (502) 338-1340

HAWESVILLE 42348
M & C AUTO PARTS*
Highway 60 East
Phone: (502) 927-2741

HENDERSON 42420
JISCO*
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Phone: (502) 826-9506

HICKMAN 42050
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Broadway & Catlett
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MACHINE SHOP*
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LAWRENCEBURG AUTO*
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375 East Main Street
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996 New Circle
Phone: (606) 254-3331

LEXINGTON 40503
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(BRANCH)
361 Southland

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321 St. George

LEXINGTON 40507
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Phone: (606) 254-1313

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Phone: (502) 491-4000

LOUISVILLE 40210
JOE HUTT MOTOR PARTS*
705 South 16th Street
Phone: (502) 583-3673

LOUISVILLE 40220
JOE HUTT MOTOR PARTS*
3942 Taylorsville Road
Phone: (502) 459-4141

LOUISVILLE 40203
KENTUCKIANA MATERIAL
HANDLING*
826 S. 6th Street
Phone: (502) 584-2223

LOUISVILLE 40299
KENTUCKY MACHINERY INC.*
3800 Crittenden Dr.
Phone: (502) 368-3321

LOUISVILLE 40203
PROCTOR AUTO PARTS &
MACHINE SERVICE INC.*
940 So. Third Street
Phone: (502) 583-3916
583-3917
583-3918

LOUISVILLE 40203
REPUBLIC DIESEL TRUCK &
MACHINE*
305 East College
Phone: (502) 585-5281

LOUISVILLE 40213
RUDD CONSTRUCTION
EQUIPMENT CO.*
4344 Poplar Level Road
Phone: (502) 456-4050

LOUISVILLE 40213
SENECA AUTO SUPPLY #2
4425 Poplar Level Road
Phone: (502) 456-5040

ROSS MACHINERY COMPANY*

South Central
Box 15707
TX 75215
(214) 428-1546

TE EQUIPMENT COMPANY*

South Cotton
Box 771
TX 79945
(915) 532-6931

ERS — PARTS AND SERVICE**WILLO 79120**
CIATED SUPPLY COMPANY,
5500

40 East
(512) 476-8386

WILLO 79105
RA-HENSON SUPPLY
West 6th
(806) 373-4285**54 78768**
SI MACHINE & GRINDING
ANY*

East First Street
(512) 476-6919

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SUPPLY COMPANY*
ON, Main
(713) 422-8331**AMONT 77705**
KEY EQUIPMENT COMPANY*
2 Cardinal Drive East
(713) 833-6407**AMONT 77705**
EL MAINTENANCE & SUPPLY*
7 Milam
(713) 833-8611**DIUS CHRISTI 78408**
RY INDUSTRIES*
2 Baldwin
(512) 883-1642**IAS 75247**
ICHALMERS MATERIAL
ILING*
Living Blvd.
(214) 637-0720**IAS**
ORKLIFT SERVICE
(214) 391-3635**IAS 75227**
DO BRYANTS ENGINE
RCE*
Ponderosa Way
(214) 381-2076**IAS 75234**
THWAITE'S OF TEXAS,
Ce

(214) 241-3103
IAS
IT INC.
(214) 637-0720

IAS 75207
ORTSON FLEET SERVICE*
Levee Street
(214) 748-7811**IAS 75208**
MURDYFILL, INC.
North Beckley
(214) 748-0041

69990

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Leon Meller, V.P. & Service Mgr.

82050

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R.L. Dabbs, President
Bill Rose, Parts Manager
Norm Edwards, Service Manager

DALLAS 75215
MOTOR BEARING & GRINDING
COMPANY*

Phone: (214) 428-5176

DALLAS 75226
NATIONAL WELDING &
GRINDING COMPANY*
2929 Canton Street
Phone: (214) 742-1811**EAGLE PASS 78852**
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160 Ford Street
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EL PASO TERMINAL SALES &
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Phone: (817) 927-8457**FORT WORTH 76101**
FORT WORTH TRADERS, INC.*
529 No. Throckmorton
Phone: (817) 332-2690**FORT WORTH 76101**
GOLDTHWAITE'S OF TEXAS
INC.*
Phone: (817) 332-1521**FORT WORTH 76119**
JOE'S FORK LIFT SERVICE*
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Phone: (817) 534-5271**GALVESTON 77550**
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ECONOMY AUTO SUPPLY
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09400
801 West North Carrier Parkway
Phone: (214) 647-0110**HEREFORD 79045**
MC RIGHT GARAGE & SUPPLY
642 East 2nd Street
Phone: (806) 364-1137**HOUSTON 77001**
DIG THREE INDUSTRIES*
3602 West 11th Street
Phone: (713) 864-7701**HOUSTON 77207**
STAPLES WELDING MACHINE
REPAIR SERVICE*
Phone: (713) 645-2163**LAREDO 78040**

LAREDO MOTOR MART*
1202 Houston Street
Phone: (512) 722-9881

LONGVIEW
EASTEX WELDING AND IND.
SUPPLY
Phone: (214) 758-7327**LUBBOCK 79404**
ASSOCIATED SUPPLY COMPANY
2402 Avenue H
Phone: (806) 747-2893**LUBBOCK 79401**
C.H. COLLIER COMPANY
102 Bdwy.
Phone: (806) 747-2788**LUBBOCK 79401**
MC KISSACK AUTO SUPPLY
1702 Avenue H
Phone: (806) 763-9255**LUBBOCK 79404**
MOTOR MACHINE SERVICE
1921 Avenue H
Phone: (806) 747-2841**LUBBOCK 79408**
PRECISION ENGINE SERVICE*
1214 Ave. "E"
Phone: (806) 763-5115**MC ALLEN 78501**
HOFF PARTS COMPANY
Phone: (512) 686-1533**MONAHANS 79756**
RUTHERFORD MACHINE
COMPANY*
1005 Calvin
Phone: (915) 943-3312**MT. PLEASANT**
MT. PLEASANT SERV. PARTS
Phone: (214) 572-3686**ODESSA 79760**
PRECISION MACHINE & SUPPLY
COMPANY* 66110
500 West Olive
Phone: (915) 332-9149**UTAH****UTAH WAREHOUSE DISTRIBUTOR**
(Dealer Sales Only)

MOTOR MERCHANTILE COMPANY, INC.**
1575 West 7800 So.
West Jordan, UT 84084
Phone: (801) 255-6893

PAMPA 79065

COE'S MACHINE SHOP
115 East Atchison
Phone: (806) 669-6651

PARIS
THE AUTOMOTIVE INC.
Phone: (214) 784-4396**PLAINVIEW 79072**
MOTOR MACHINE SERVICE
205 East 8th Street
Phone: (806) 296-6280**PORT ARTHUR 77640**
SPENCE BATTERIES AND
ELECTRIC*
321 7th Street
Phone: (713) 983-4522**SAN ANGELO 76901**
ROGERS MACHINE COMPANY
113 E Concho
Phone: (915) 655-7363**SAN ANTONIO 78217**
GOLDTHWAITE'S OF TEXAS,
INC.*
Phone: (512) 653-9660**SAN ANTONIO 78204**
GONZALEZ LIFT TRUCK SERVICE
COMPANY
302 W. Gunther Street
Phone: (512) 226-1266**SAN ANTONIO 78219**
THE ROY KLOSNER COMPANY*
727 North White Road
Phone: (512) 333-8311**TEXAS CITY 77590**
NASH AUTOMOTIVE*
914 Texas Avenue
Phone: (713) 945-7475**TYLER**
EAST TEXAS AUTO SUPPLY
Phone: (214) 597-5558**DEALERS — PARTS AND SERVICE****MIDVALE 84047**
MOTOR MERCHANTILE
COMPANY*
1048 East Union Blvd.
Phone: (801) 255-3541**PROVO 84601**
MOTOR MERCHANTILE
COMPANY*
54 North 4th, West
Phone: (801) 373-4381**SALT LAKE 84125**
STREVELL-PATERSON SHOP*
1401 South 700, West
Phone: (801) 973-2323**SALT LAKE CITY 84104**
C.W. SILVER COMPANY*
550 West 7th, South
Phone: (801) 355-5373**WEST JORDAN 84084**
MOTOR MERCHANTILE
COMPANY*
1575 West 7800 South
Phone: (801) 255-6893

MAIN GENERATOR

Kurz and Root Company
Subdivision of Bronson Electronics
1010 N. Meade St.
Appleton, Wis. 54911

Phone (414) 739-9441

Model E1364E 1365M837D

60 Cycle, 1800 RPM

12.5 KVA, 10 KW, .8PF

Volts/Amp

3 phase Wye 120/208V - 35a

3 phase delta 120V -60a

1 phase delta 120V -104a

1 phase Z 120/240V -52a

PRESTOLITE SERVICE INFORMATION

STARTER

D.C. GENERATOR

VOLTAGE REGULATOR

Prestolite Electrical Div. of Eltra

Technical Service

511 Hamilton St.

Toledo, Ohio 43694

Phone (419) 255-4068 Herb Minerger

Starter

Model - MDZ - 6001T

Generator

Model - GHP6002AT111T

Volt Regulator

Model - VBO - 4402-AT-1



prestolite®

SERVICE

INFORMATION

MDZ

Starting Motors

Page 1 of 2

Issued 3/16/78

VOLTAGE 24ROTATION CWDEBRUSHES 4POLES 4DIAMETER 4-1/2"LUBRICATION

Soak all bronze bearings and felt oiling pads in SAE-20 oil. Drain thoroughly before assembly.

Lubricate armature shaft at drive end with a film of lubricant before assembling drive.

BRUSH REPLACEMENT

Replace brushes when they have worn to a length of 1/4" or less.

SPRING TENSION

32 to 40 ounces with new brushes. Measure with a spring scale hooked under the brush spring at the brush. Pull the scale on a line opposite the line of force exerted by the brush spring and take the reading just as the spring leaves the brush.

TRANSMISSION

Mag. clutch.

END PLAY

Adjust to .005 to .030 with thrust washers a comm end head. See Parts & Equipment List for thrust washer package.

POLE SHOE INSTALLATION

Due to the method of installing field coils in this assembly, it is necessary to replace the Frame and Field Assembly if field coils are required.

MAGNETIC SHIFT CLUTCHES

With plunger sealed, pinion pushed toward commutator end, and pinion stop pushed toward drive end bearing adjust link screw to obtain a clearance of 3/32" + 1/32"-1/64" between the pinion and the pinion stop.

TEST SPECIFICATIONS (77°F/25°C)

	Terminal Voltage	Maximum Amperes	RPM	Torque Ft. Lbs.
No Load Test	20.0	14	3600	-0-
Stall Torque Test	8.0	80	-0-	6.0

Unit

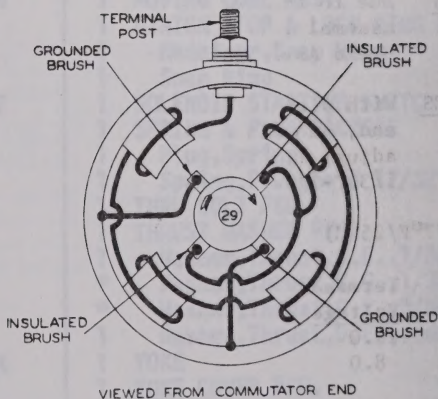
MDZ-6001T

Note 1 - The pinion housing bearing must be flush with the bearing bore on the inside of the housing.



**prestolite.****SERVICE****INFORMATION**

- Note 2 - The intermediate bearing must be flush with the bearing bore nearest the armature.
- Note 3 - The pinion will be against the pinion stop when cranking.
- Note 4 - After inspection of various parts, paint stud and brush holder insulation with red glyptol. Cover glyptol and all metal surfaces except pilots, head seats, threads, commutator and bearing surfaces with air-drying, fungus-resistant insulating varnish. Allow varnish to soak into field coils and armature windings and dry thoroughly before assembly. After assembly seal end head joints, brush holder rivet holes and opening around clutch linkage cover with vinyl lacquer.



**prestolite****SERVICE PARTS LIST**ASSY. NO. MDZ-6001TSALES NO. 46-257STARTING MOTORISSUED 1-9-75 (Rev.)Application Continental Motors(Military), Davey Comp., Kurz & Root

Reference Part No.	Service Part No.	No. Used	Part Description	Prestolite Sales No.
	MDZ-2048FT	1	ARMATURE	
	MDZ-3075	1	CLUTCH, STARTER	
	MDZ-2021	1	FRAME & FIELD ASSY. **	
	+	1	Brush	
	90-242	1	HARDWARE PKG., BRUSH PLATE MTG.	
	MDL-1064A	1	PLATE ASSY., BRUSH	
	+	2	Brush, Grounded	
	MZ-19CS	1	SPRING SET, BRUSH	
	90-379	1	SW. CONN. & GROMMET PKG.	
		1	Connector, Switch	
		1	Grommet, Connector	
	MEL-39S	1	GASKET PKG., YOKE COVER (2PCS.)	
	MDL-1002C	1	HEAD ASSY., COMM. END	
	PS-1373	1	HOUSING ASSY., PINION	
	MP-41A	1	BEARING, ABS. BRONZE	
	90-644	1	MISC. YOKE PARTS PKG.	
		1	Cover, Yoke Pin	
		1	Pin, Link	
		1	Pin, Yoke	
	SAD-1021B	1	MOVING CORE ASSY.	
	90-502	1	PINION STOP & LOCK RING PKG.	
		1	Retainer, Snap Ring	
		1	Snap Ring	
	SAL-4001T	1	SOLENOID STARTING SWITCH	
	SAD-27AS	1	SPRING & PLUG PACKAGE	
		1	Plug, Spring	
		1	Spring, Plunger, 3 17/32"	
	MW-20DS	1	THRU BOLT PKG.	
	90-503	1	THRUST WASHER PKG.	
		1	Washer, Thrust, C.E., 1/32" Thick	
		*	Washer, Thrust, C.E., 1/32" Thick	
		*	Washer, Thrust, C.E., 3/64" Thick	
		1	Washer, Thrust, D.E., .065" Thick	
	MCH-1074A	1	YOKE	
	90-504	1	YOKE COVER PKG.	
		1	Cover, Yoke, L.H.	
		1	Cover, Yoke, R.H.	
		4	Screw, Yoke Cover, Rd. Hd. #8-18 x 1/4	
	MDZ-2012AS	+	BRUSH SET, SERVICE	

* Use as required.

** Due to the method of installing Field Coils in this Assembly, it is necessary to replace the Frame & Field Assy. if Field Coils are required.



<u>VOLTS</u>	24	<u>RATED OUTPUT</u>	18 Amperes	<u>VENTILATED</u>	Yes
<u>ROTATION</u>	CWDE	<u>BRUSHES</u>	2	<u>POLES</u>	2
<u>CONTROL</u>	Vibrating Current-Voltage Regulator				
<u>GROUND POLARITY</u>	Negative	<u>BEARINGS</u>	Ball at drive end. Absorbent bronze at commutator end.		

LUBRICATION

Periodically add 5 drops of medium engine oil to end head oilers. At overhaul, pack open ball bearings 1/4 to 1/2 full with a good ball bearing lubricant. NOTE - Some ball bearings are sealed, these units are prelubricated and require no additional lubrication.

BRUSH SPRING TENSION

35 to 53 ounces with new brushes. Brush tension is measured with the scale hooked in the hole in the end of the brush arm and pulled on a line perpendicular to the top of the brush. Take the reading just as the arm leaves the brush.

FIELD COIL DRAW (70°F.)

.83 to .87 amperes at 20.0 volts

MOTORING DRAW (70°F.)

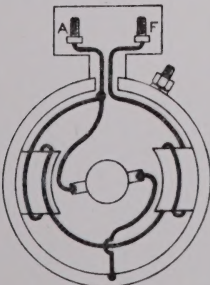
2.4 to 2.7 amperes at 20.0 volts
(Have field terminal grounded to frame.)

OUTPUT TESTS (70°F.)

26.4 volts, 5 amperes at 1450 maximum RPM.
28.6 volts, 18 amperes at 1900 maximum RPM.

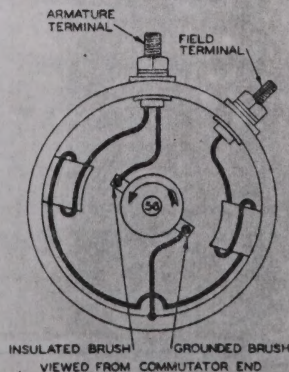
Units	Internal Wiring	Special Instructions
GHP-6001AT, T-S1	Fig. 1	See Note 1
GHP-6002AT, AT-1, BT, CT, N, DT, TS-1	Fig. 2	See Note 1
GHP-6002S-1	Fig. 2	
GHP-6003AT	Fig. 2	See Note 1

Note 1 - After inspection of various parts, paint terminal stud and brush holder insulation with red glyptol. Cover glyptol and all metal surfaces except pilots, head seats, threads, commutator and bearing surfaces with air-drying, fungus-resistant insulating varnish. Allow varnish to soak into field coils and armature windings; then drain and dry thoroughly before assembling generator.



VIEWED FROM COMMUTATOR END

Figure 1



VIEWED FROM COMMUTATOR END

Figure 2



prestolite®

SERVICE PARTS LIST

GHP-6000 SERIES

GENERATORS

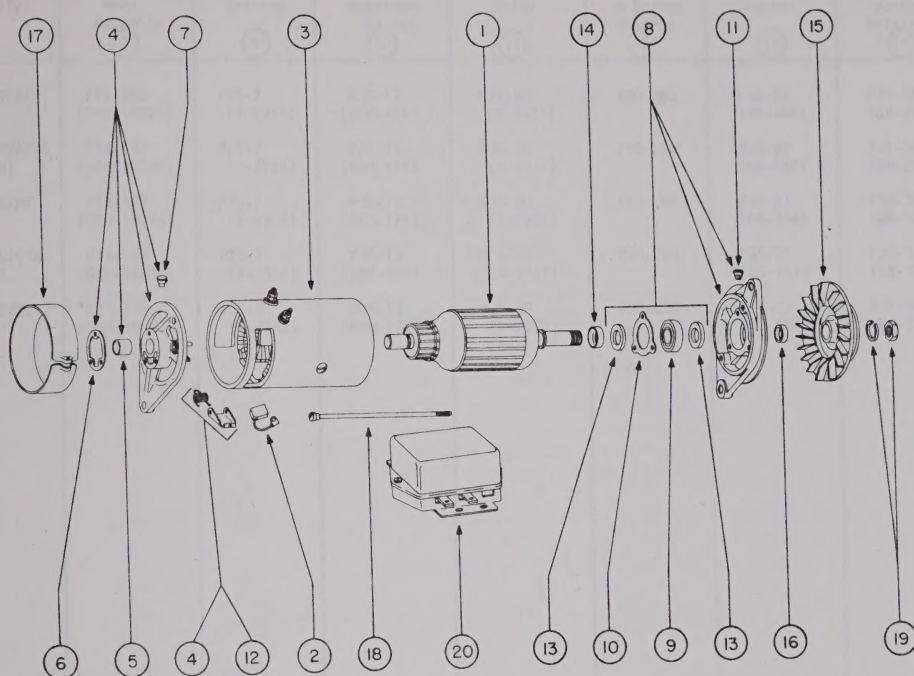
ISSUED: 5-10-68

<u>ASSEMBLY</u>	<u>SALES NO.</u>	<u>APPLICATION</u>
GHP-6002AT	- - -	Chrysler Industrial(Military)
GHP-6002AT-1	P45-240	Continental(Military)
GHP-6002BT	- - -	Chrysler Industrial(Military)
GHP-6002CTN	P45-99	Continental(Military)
GHP-6002TS-1	P45-261	Service

Exploded View of Typical GHP Generator

Assembly	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GHP-6002AT	110-110	110-110	110-110	110-110	110-110	110-110	110-110
GHP-6002AT-1	110-110	110-110	110-110	110-110	110-110	110-110	110-110
GHP-6002BT	110-110	110-110	110-110	110-110	110-110	110-110	110-110
GHP-6002CTN	110-110	110-110	110-110	110-110	110-110	110-110	110-110
GHP-6002TS-1	110-110	110-110	110-110	110-110	110-110	110-110	110-110

GHP-6000 Series Generator Parts List



Exploded View of Typical GHP Generator

Assembly	Armature ①	Brush Set ②	Frame & Field Assembly ③	Comm. End Head Assembly ④	C.E. Bearing ⑤	C.E. Cover Gasket ⑥	C.E. Oiler ⑦
GHP-6002AT	P10-148 (GHF-2006AFT)	P11-44 (GBW-2012CS)	P60-92 (GHP-2001S)	P12-187 (GHP-2002S)	P24-5 (GGU-38A)	P35-229 (GGU-33)	P35-90 (X-3931)
GHP-6002AT-1 (P45-240)	P10-148 (GHF-2006AFT)	P11-44 (GBW-2012CS)	P60-81 (GHP-2001S-1)	P12-187 (GHP-2002S)	P24-5 (GGU-38A)	P35-229 (GGU-33)	P35-90 (X-3931)
GHP-6002BT	P10-148 (GHF-2006AFT)	P11-44 (GBW-2012CS)	P60-92 (GHP-2001S)	P12-187 (GHP-2002S)	P24-5 (GGU-38A)	P35-229 (GGU-33)	P35-90 (X-3931)
GHP-6002CTN (P45-99)	P10-148 (GHF-2006AFT)	P11-44 (GBW-2012CS)	P60-81 (GHP-2001S-1)	P12-187 (GHP-2002S)	P24-5 (GGU-38A)	P35-229 (GGU-33)	P35-90 (X-3931)
GHP-6002TS-1 (P45-261)	P10-148 (GHF-2006AFT)	P11-44 (GBW-2012CS)	P60-92 (GHP-2001S)	P12-187 (GHP-2002S)	P24-5 (GGU-38A)	P35-229 (GGU-33)	P35-90 (X-3931)

GHP-6000 Series Generator Parts List

Sheet 2

Assembly	Drive End Head Assembly (8)	D.E. Bearing (9)	Bearing Retainer Gasket (10)	D.E. Oiler (11)	Brush Arm & Spring Package (12)	Felt Washer (13)	Felt Washer Retainer (14)
GHP-6002AT	P14-192 (GGU-1003C)	P25-7 (X-295A)	P35-13 (GBM-124)	P35-90 (X-3931)	P90-260	P35-21 (GG-164)	P35-365 (GR-32B)
GHP-6002AT-1 (P45-240)	P14-192 (GGU-1003C)	P25-7 (X-295A)	P35-13 (GBM-124)	P35-90 (X-3931)	P90-260	P35-21 (GG-164)	P35-365 (GR-32B)
GHP-6002BT	P14-192 (GGU-1003C)	P25-7 (X-295A)	P35-13 (GBM-124)	P35-90 (X-3931)	P90-260	P35-21 (GG-164)	P35-365 (GR-32B)
GHP-6002CTN (P45-99)	P14-192 (GGU-1003C)	P25-7 (X-295A)	P35-13 (GBM-124)	P35-90 (X-3931)	P90-260	P35-21 (GG-164)	P35-365 (GR-32B)
GHP-6002TS-1 (P45-261)	P14-192 (GGU-1003C)	P25-7 (X-295A)	P35-13 (GBM-124)	P35-90 (X-3931)	P90-260	P35-21 (GG-164)	P35-365 (GR-32B)

Assembly	Drive Pulley (15)	Armature Shaft Spacer (16)	Cover Band (17)	Thru Bolt Package (18)	Nut & Washer Package (19)	Regulator (20)	
GHP-6002AT	P34-280 (SP-1913A)	- - - -	P35-464 (GCE-24P)	P35-465 (DK-23DS)	P90-130	P8-189 (VBO-4402AT)	
GHP-6002AT-1 (P45-240)	P34-280 (SP-1913A)	P35-462 (GEG-55A)	P35-464 (GCE-24P)	P35-465 (DK-23DS)	P90-130	P8-189 (VBO-4402AT)	
GHP-6002BT	P34-330 (PU-1041A)	- - - -	P35-464 (GCE-24P)	P35-465 (DK-23DS)	P90-130	P8-189 (VBO-4402AT)	
GHP-6002CTN (P45-99)	P34-325 (PU-109)	P35-462 (GEG-55A)	P35-464 (GCE-24P)	P35-465 (DK-23DS)	P90-130	P8-189 (VBO-4402AT)	
GHP-6002TS-1 (P45-261)	- - - -	- - - -	P35-464 (GCE-24P)	P35-465 (DK-23DS)	P90-130	P8-189 (VBO-4402AT)	

VOLTS 24GROUND POLARITY See tabulation.RESISTORS - See tabulation.CIRCUIT BREAKER

Resistance of winding -	525 to 585 ohms.
Armature air gap -	.025" to .027".
Contact point gap -	.015" minimum.
Contacts close -	25.0 to 26.5 volts.
Contacts open -	1.5 to 3.0 amperes discharge after a charge of 5 amperes.
	Adjust by changing contact gap, keeping contacts aligned.

VOLTAGE REGULATOR

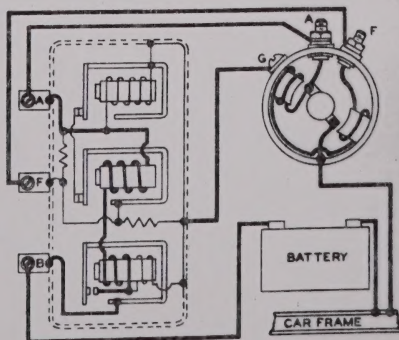
Resistance of winding -	212 to 237 ohms.
Armature air gap -	.057" to .060". Contacts should be closed with the high limit gauge in place and open with the low limit gauge in place between the armature and core on the side of the armature stop rivet toward the free floating end of the armature.
Operating voltages -	Figures are for a unit in normal operation while charging at 7 amperes output (one-half current rating if below 14 amperes) after 15 minutes of operation.

Temp. F.	50°	80°	110°	140°	Tolerance
Volts	28.8	28.3	27.8	27.3	±.6

CURRENT REGULATOR

Armature air gap -	.057" to .060". Contacts should be closed with the high limit gauge in place and open with the low limit gauge in place between the armature and core at the center of the core.
Operating amperage -	See tabulation.

Unit	Grd. Pol.	R1		R2		Operating Amperes
		Marked	Ohms	Marked	Ohms	
VBO-4401A, -1, AT, -1	Pos. -Neg.	200	190-210	200	190-210	4.8-5.2
VBO-4401B, -1, -4, BT, -1	Pos. -Neg.	200	190-210	200	190-210	9.5-10.5
VBO-4402A, -1	Pos. -Neg.	200	190-210	200	190-210	4.8-5.2
VBO-4402AT, -1, ATC	Neg.	200	190-210	200	190-210	17.0-19.0



IGNITION SYSTEM

Fairbanks Morse Engine

Accessories Operation

Beloit, Wis. 53511

Phone (608) 364-4411

Dean Ziegenbien

Model CW - Type -20

FM - XE4B16W

Serial 4909478

Mfd. for F162M-448



Colt Industries

INSTRUCTIONS
TYPE FM-E, X, Z
MAGNETOS

ENGINE ACCESSORIES OPERATION • BELOIT, WISCONSIN 53511

SERVICE INSTRUCTIONS

TYPE FM-E, FM-X, FM-XD, FM-XDE, FM-XE, FM-XF, FM-XFE, FM-XFZ, FM-XO, FM-XOR, FM-XR, FM-XV, FM-XVE, FM-XY, FM-XYE, FM-XZ, FM-XZE, FM-Z AND FM-ZE MAGNETOS

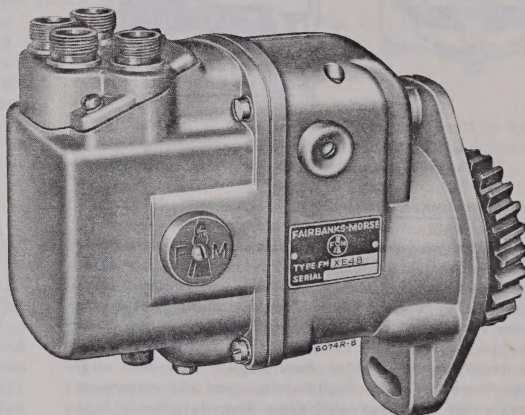
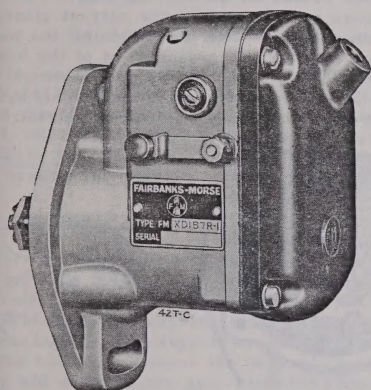


Fig. 1. Standard and Radio Shielded Magnetos

GENERAL DESCRIPTION

Fairbanks Morse Series X magnetos, Fig. 1, are of the rotating magnet design, the basic principle consisting of inducing and continually reversing magnetic flux lines thru an induction coil. This is accomplished by rapidly rotating the permanent magnetic rotor through a stationary field which is the basis of the magnetic circuit.

A one, two, or four-lobe cam actuates a breaker mechanism periodically during each revolution of the rotor. Each time the breaker points are separated by the magnetic rotor cam, an ignition spark is produced. In the one-cylinder magnetos this occurs once per revolution of the rotor. In the two-cylinder magnetos the distributor rotor forms an axial extension of the magnetic rotor and the breaker points are separated twice per revolution of the rotor by a two-lobe cam. Similarly, in the type FM-XV four-pole magnetos, the distributor rotor forms an axial extension of the magnetic rotor. Since the cam of the rotor has four lobes, the breaker points separate four times per revolution producing four ignition sparks. In the standard four-cylinder magnetos, a two-lobe cam is used which produces two ignition sparks per revolution of the magnetic rotor. In all such cases an ignition spark is furnished to each high tension outlet, once for every two revolutions of the magnetic rotor.

In the FM-XR6 and FMZ6 six-cylinder magnetos, a two-lobe cam is used which produces two ignition sparks per revolution of the magnetic rotor. A gear arrangement is used to connect the magnetic rotor with the distributor rotor which furnishes a spark to each high tension outlet once for every three revolutions of the magnetic rotor.

MAGNETO INSPECTION

The entire magneto should be inspected for worn parts every 1000 hours of operation.

End Cap and End Cap Removal

When the usual inspection and spark tests indicate poor magneto performance, the end cap and end cap cover, Fig. 2, if used, should be removed. Tag the ignition cables to insure their proper replacement in the endcap; then remove each high-tension cable from its socket. In the type FM-E magnetos, the end cap cover must be removed to expose the high tension cable terminals before the lead wires can be removed. When removing the end cap of the types FM-X4, FM-XR, FM-XOR, and the FM-XV magnetos, the end cap cover must be removed and the distributor rotor taken off the end of the rotor shaft before the end cap can be removed.

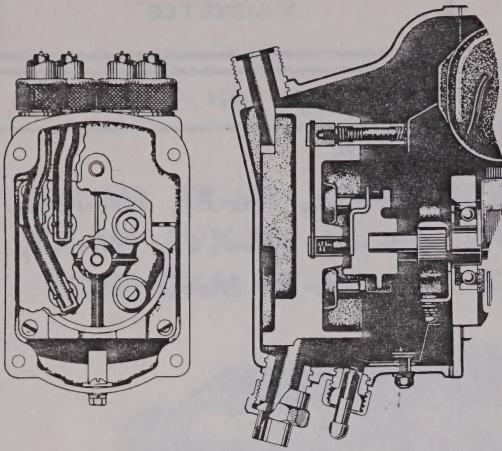


Fig. 2. End Cap and High Tension Cable Terminals

Carbon Brush and Spring

Magnetos for engines with two or more cylinders have a carbon brush and spring assembly in the center of the end cap cover, Fig. 3. Multi-cylinder radio-shielded magnetos have a distributor block in the end cap which contains a carbon brush and spring. Examine the brush and replace it if worn or damaged. The brush should move freely in its holder and should be under slight spring pressure. The high tension lead and suppressor assembly can be unscrewed from the distributor block for inspection, cleaning or replacement.

Breaker Arm, Support Bracket and Points

Breaker points should be checked and adjusted every 500 hours of operation.

To remove the breaker point assembly, Fig. 4, take out the breaker arm terminal screw which releases the coil lead wire, condenser lead, ground contact, and breaker

arm spring. Then slide off the fulcrum pin snap ring and lift the breaker arm off the fulcrum pin. Take out the two contact support locking screws, lockwashers and plate washers, and lift the support bracket from the bearing support.

Inspect the breaker points for pitting or pyramiding. A small tungsten file or fine stone should be used to resurface the points. If the points are badly worn or pitted they should be replaced. When the breaker points have been resurfaced or replaced be sure to adjust them to their proper clearance of 0.015 $\pm$ 0.002 in. at high point of cam. This adjustment is made in the following manner: Loosen the two contact support locking screws. Insert a screwdriver in the horizontal slot at the bottom of the contact support and move it by pivoting the tool between the two small bosses on the bearing support until the breaker points are adjusted to the correct clearance. Lock the assembly in place by tightening the locking screws; then take a final measurement of the breaker point gap after the locking screws are tightened. The carbon film should be removed from the breaker points by using a brush and a small quantity of petroleum solvent.

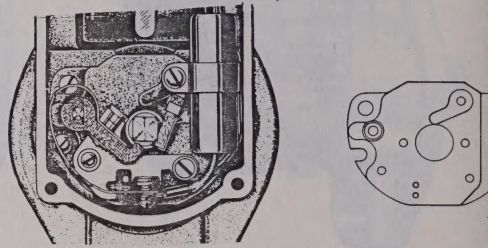
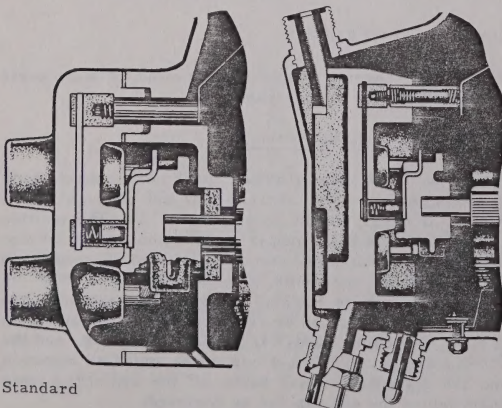


Fig. 4. Bearing Support with and without Point Set, Condenser and Cam Wick

Condenser

Remove the standard condenser from the magneto by unscrewing the condenser mounting screw, Fig. 5. To remove the feed-thru condensers on the FM-E6, FM-FM-XFE, FM-XVE, FM-XYE and FM-XZE multi-cylinder radio-shielded magnetos, take out the two condenser mounting screws.

Clean the condenser and lead wire with a dry cloth. Do not damage the lead wire. Then inspect lead wire for damage. Test the condenser for open circuit on a reliable condenser tester or substitute an identical new condenser in its place. The capacity of the AX-M-R-2 condenser is 0.17-0.23 mfd. The capacity of the S-



Standard

Radio Shielded with Distributor Block

Fig. 3. Magnetos with Brush and Spring

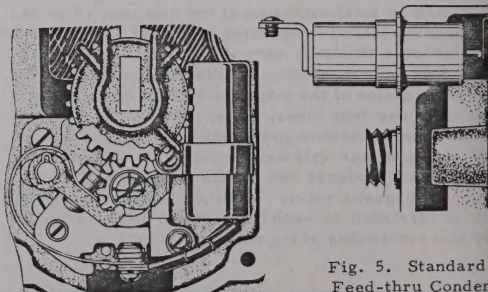


Fig. 5. Standard Feed-thru Condenser

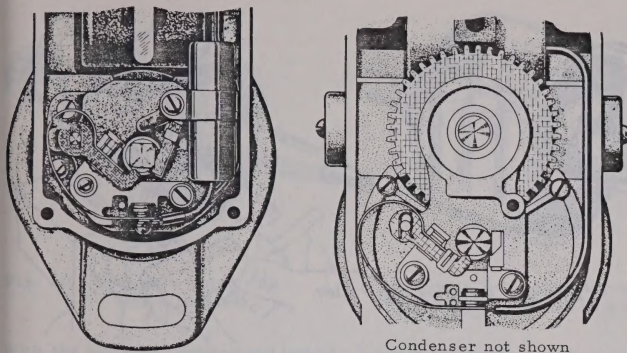


Fig. 6. Two Types of Bearing Supports, CW Rotation

-2433 Condenser is 0.28-0.36 mfd. The capacity of the L-V-2433 condenser is 0.37-0.43 mfd. The capacity of feed-thru condensers is as follows: HX2433 0.28-0.36 mfd, JX2433 0.17-0.23 mfd, KX2433 0.28-0.36 mfd and MX2433 0.28-0.35 mfd. Test the condenser at 440v dc for breakdown voltage.

Bearing Support Assembly

Before removing the bearing support assembly, Fig. 6, be sure the breaker arm terminal screw has been removed. On types FM-X4, FM-XE4, FM-XF, FM-XFE, and FM-XZE, the magnetic rotor gear must be removed before the bearing support assembly can be taken out of the housing. Remove the magnetic rotor gear snap ring and draw off the gear using the pinion gear puller OMT76. The magnetic rotor gear pin can then be taken out. On later model magnetos the new style magnetic rotor gear Q5952 can be easily removed after taking off the rotor gear snap ring. Then take the bearing support out of the magneto housing.

On types FM-E, FM-XR and FM-XOR magnetos, if the bearing support is hard to get out, remove the impulse coupling on flange mounting magnetos, and lift out the oil slinger baffle disc, replace the impulse coupling nut on the rotor shaft, and strike the shaft a sharp blow. This will loosen the bearing support so it can be lifted out of the housing. The outer race of the rotor cam end bearing will remain in the bearing support.

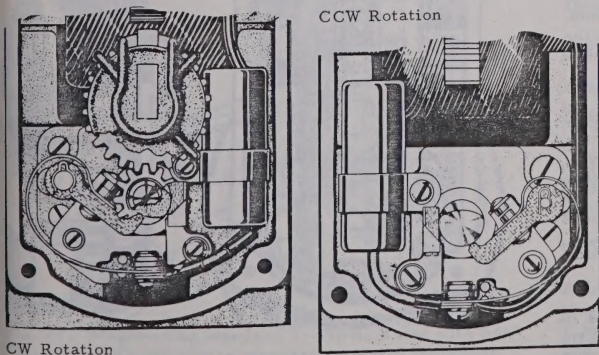
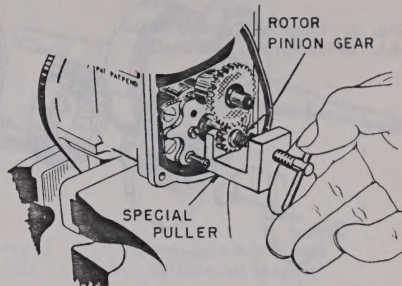


Fig. 7. Bearing Support with and without Distributor Gear

Fig. 6a. Use of
OMT76 Magnetic Rotor Gear Puller

Coil - All FM-X Magnetos

The removal of the coil in all magnetos will be easier if the magnetic rotor is turned to place the magnets in a vertical position or until the flux lock is broken.

The coil in magnetos which have no reduction gear, Fig. 7, between the magnetic rotor and the distributor rotor, can be easily removed for testing. Take out the breaker arm terminal screw, remove the coil lead wire and the condenser. Loosen the coil bridge setscrews located on top of the housing at each side, then slide the coil out of the housing.

The coil in a magneto which has the distributor rotor geared to the magnetic rotor can be removed only after the bearing support assembly has been taken out of the housing. Refer to paragraph Bearing Support Assembly.

Clean the coil lead wire with a dry cloth; do not damage the lead wire. Inspect the coil visually for cracks or exposed windings which would be cause for discarding the coil. Test the coil on a reliable tester.

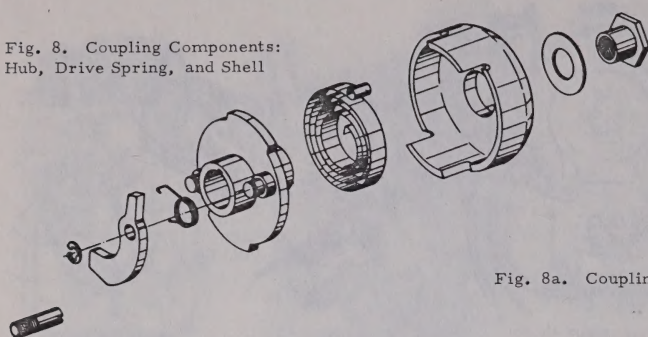
Impulse Coupling

Although much service work can be performed on the magneto without taking the impulse coupling off the rotor shaft, the removal of the magnetic rotor will necessitate complete removal of the coupling. We recommend that the coupling be removed for cleaning and lubrication whenever major service work is done on the magneto.

An impulse coupling is a mechanical device installed on the magnetic rotor shaft between the magneto and engine drive. Its prime purpose is to intensify the ignition spark at low rotative speed, and to automatically retard the ignition spark during the engine starting to eliminate backfire.

The impulse coupling assembly, Fig. 8, consists of a shell, flat or coiled drive spring and coupling hub assembly with or without pawl springs, which is keyed to the magnetic rotor shaft. The drive spring has one end engaged in the longer slot in the coupling hub while the other end has a loop formed which fits into the coupling shell. The coupling shell is fitted into the drive member on the engine drive shaft.

Fig. 8. Coupling Components:
Hub, Drive Spring, and Shell



When the engine is operating at slow speed, the pawl in the coupling hub engages the stop pin in the magneto housing, which prevents further movement of the magnetic rotor. As the engine continues to operate the shell winds up the drive spring. At the point in the engine cycle when the fuel mixture should be ignited, the pawl is released by movement of the coupling shell, and snaps the magnetic rotor forward at high speed through its firing cycle. As the engine speed increases, centrifugal force withdraws the pawls to a position where they no longer engage the stop pin.

In applications where the magneto operates in other than a horizontal position, the force of gravity cannot act upon the coupling pawls during the starting period. To cause the necessary engagement action, small wire springs are attached to each coupling pawl.

To remove the complete impulse coupling, take out the impulse coupling nut lockwire or turn down the lugs of the impulse coupling nut lockwasher; remove the impulse coupling nut and lockwasher. In the base mounted magnetos, remove the impulse outer shell screws, lift out the outer shell cupped washer and the outer shell felt washer.

Remove the complete impulse coupling from the magneto by using the OMT8 puller. If the tension applied by the puller does not loosen the coupling, tap the puller screw with a hammer, which will jar the coupling loose from the rotor shaft. When the coupling is removed, lift out the coupling outer shell flat washer used on base mounting magnetos. The coupling should be disassembled only by an experienced service station. In the event the shell comes loose from the hub when the coupling nut is taken off, care must be exercised in re-assembly.

Place the coiled end of the coupling spring in the slot in the shell in the correct rotation for the magneto: clockwise for CW rotation, counterclockwise for CCW rotation viewed when the coupling shell is turned up. Engage the straight end of the spring in the longer slot in the coupling hub and turn the hub one full turn, then push the assembly together and install it onto the magneto.

Distributor Gear Assembly

There are three types of distributor bearings used in FM-X magnetos. An oilite sleeve bearing or a needle bearing may be used in types FM-X4, FM-XE, FM-XF2 FM-XYE and FM-XZE magnetos. To remove the distri-

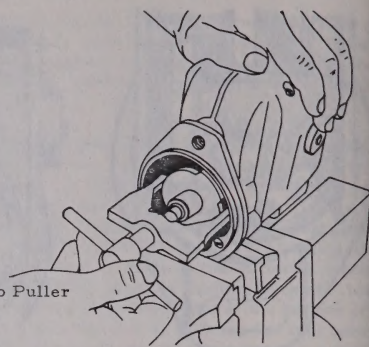


Fig. 8a. Coupling Hub Puller

butor rotor gear, remove the distributor shaft snap ring and slide the shaft and gear from the bearing support, Fig. 9.

Ball bearings are used in the FM-E, FM-XR, and FM-XOR magnetos. To remove the distributor bearing from these magnetos, take out the distributor shaft snap ring. Place a piece of soft lead on the bench, turn the bearing support over so the distributor shaft points downward, grip the bottom of the bearing support with both hands, and strike the end of the distributor shaft on the lead a few times to jar the shaft loose from the bearing.

Distributor sleeve bearings may be pressed out of their respective bearing supports by means of the hand screw press 370TD, and the distributor bearing tool TD2252A. To remove the distributor ball bearing, take off the distributor bearing snap ring and press the bearing out of its support.

Magnetic Rotor Types FM-X, FM-XV

There are three types of magnetic rotors used in the series X magnetos: a two-pole rotor with block magnets; a two-pole rotor with bar magnets perpendicular to the rotor axis; a four-pole rotor with a cylindrical magnet, Fig. 10.

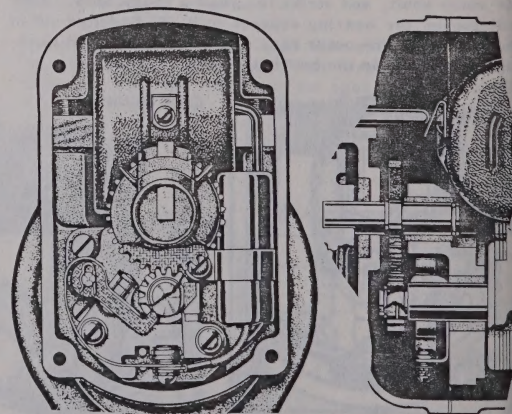


Fig. 9. Bearing Support with Distributor Gear Assembly and Distributor Rotor

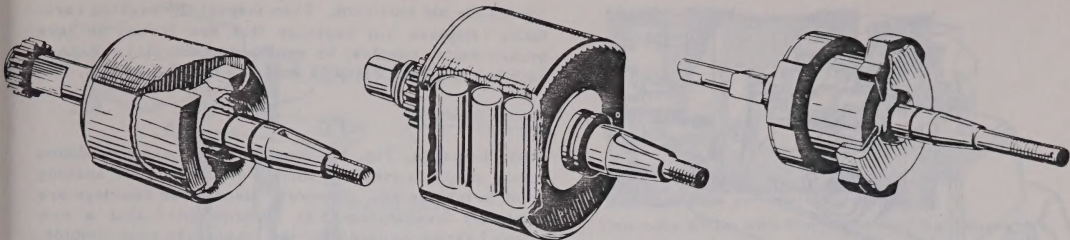


Fig. 10. Two-pole Rotor with Block Magnets.

Two-pole Rotor with Bar Magnets Placed Perpendicular to Rotor Axis

Four-pole Rotor with Cylindrical Magnet

With the impulse coupling and bearing support removed, take out the oil slinger baffle disc, found only on flange mounting magnetos with integral flange. Then remove the rotor drive end seal outer washer by striking it with a punch on the shaft edge. This dishe the washer and permits easy removal. On more recent models, the rotor drive end seal outer washer is made with one edge cut flat making it easy to insert the point of a screw-driver and loosen the washer. Discard the washer after it has been removed from the magneto.

Lift out the rotor drive end seal and the rotor drive end seal inner washer. This washer is a loose fit but may be difficult to remove due to the adhesion of bearing grease. Finally, remove the magneto rotor shaft snap ring which is found only on the types FM-X, FM-XD, FM-XDE, FM-XE, FM-XF, FM-XFE and FM-XZE magnetos.

Press the rotor out of the housing. Place the assembly in the adjustable press with the cam end of the rotor shaft carefully centered in the large hole of the base plate. Then place the brass protective cap over the threaded end of the rotor shaft and apply an even pressure by slowly turning the drive screw. As soon as the rotor is pressed out of the drive end bearing it may be removed from the magneto housing.

In magnetos that have the rotor drive end bearing retaining washer, this washer must be removed before the bearing can be pressed out of the housing.

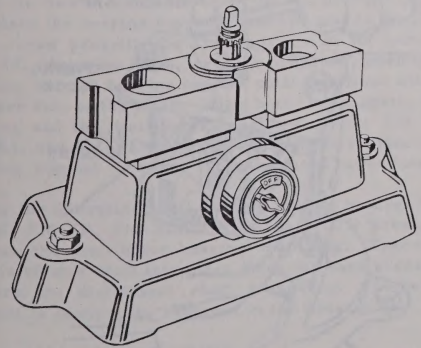


Fig. 11. Magnetizing Standard Two-pole Rotor with Bar Magnets. To magnetize standard two-pole rotor with block magnets, use same setup but reverse charging blocks.

Remagnetizing Magnetic Rotor

Due to the exceptional stability of the Alnico magnets used in Fairbanks Morse magnetos, it is recommended that the rotor be remagnetized only when it has been definitely determined that the ignition spark is below the required minimum value. The remagnetizing process involves the use of suitable equipment and should be undertaken in accordance with the following instructions.

Magnetization

The length of the magnetizing time depends on the type and strength of the charger. It is recommended that the rotors be given a minimum charge of 30 seconds, broken into two periods, or "shots." Arrangements should be made to place the rotor in the magneto housing as soon as it is taken from the magnetizer.

Two-pole Rotors

Determine the polarity of the rotor and the magnetizer, Fig. 11. Place the magnetic pole of the rotor, which attracts the N pole of a compass, in contact with the magnetic pole of the charger which attracts the S pole of the compass. By holding the rotor in the vicinity of a charger while it is in operation, the attraction of unlike poles is easily discernible.

All rotors except those for type FM-XV magnetos are of the two-pole design and should be placed in the charging blocks as described above. The large radii of the charging blocks should be used for rotors from types FM-E, FM-XR and FM-XOR magnetos, and the small radii should be used for rotors from type FM-X units.

Four-pole Rotors

Four-pole rotors, Fig. 12, used in type FM-XV magnetos, must be remagnetized with special care. These rotors have large cylindrical magnets with the axis of the poles parallel to the shaft. The magnetizing blocks must be placed on the charger with maximum surface contact. Insert the rotor in the drilled holes of the magnetizing block with the keyway up.

Drive End Ball Bearing

Release the bearing snap ring with snap ring pliers, and place the magneto in the hand screw press 370TD. Put a brass protective cap over the center of the bearing, Fig. 13. As the screw is turned down, center the assembly in the press. Apply pressure evenly to the inner bearing race until the inner bearing race and ball re-

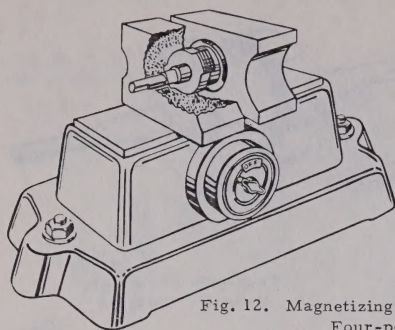


Fig. 12. Magnetizing Standard
Four-pole Rotor

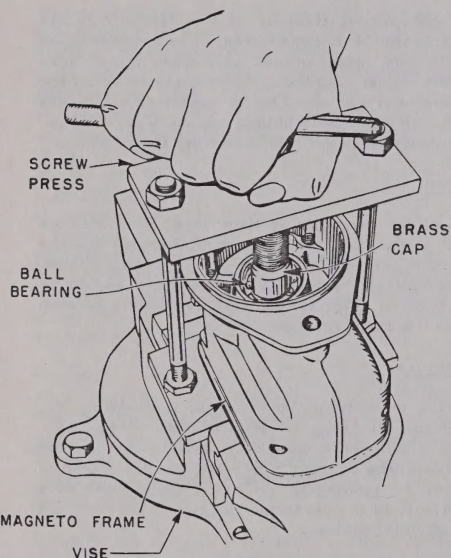


Fig. 13. Pressing Ball Bearing Out of Housing

taining ring are pressed out. The outer bearing race will remain in the housing and may be pressed out if desired. If the bearing is of the non-separable type, the outer race driver must be used with 370TD hand press to press the entire bearing out of the housing

Ball and Needle Bearings

Clean the grease out of the ball bearing, Fig. 14, and the needle bearings, Fig. 15, if used, by soaking them in a petroleum solvent, turning the bearing cage slowly to

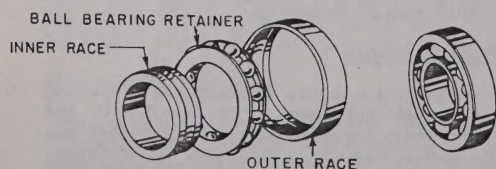


Fig. 14. Separable and Non-separable Ball Bearings

loosen the old lubricant. Then inspect the bearing carefully. Replace any bearings that are frozen or have broken balls, needles, or excessive axial play. Repack each bearing with FMCO11 magneto bearing grease.

Sleeve Bearings

Oilite bearings, Fig. 16, found in serviceable condition during magneto overhaul may be replaced after soaking them in turbine oil. However, since these bearings are relatively inexpensive it is recommended that a new sleeve bearing be used when the magneto is reassembled.

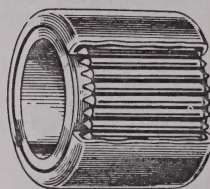


Fig. 15. Needle Bearing

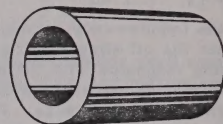


Fig. 16. Sleeve Bearing

Miscellaneous Parts

All other parts should be cleaned with a small, stiff brush moistened with a petroleum solvent. Inspect all castings and machined parts for chips, cracks, stripped or mutilated thread or other defects. Inspect all gears for chips, cracks, broken teeth; all bearing surfaces and keyways and all springs for bending, cracking or loss of tension. Replace any defective parts.

REASSEMBLY OF MAGNETO

If during the overhaul of the magneto the housing has been cleaned with any type solvent solution, be sure to remove any traces of the solution with water and finally remove any remaining water and foreign material with a

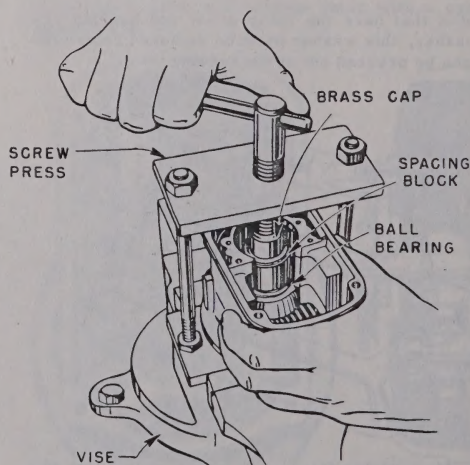


Fig. 17. Pressing Rotor Drive End
Bearing into Housing

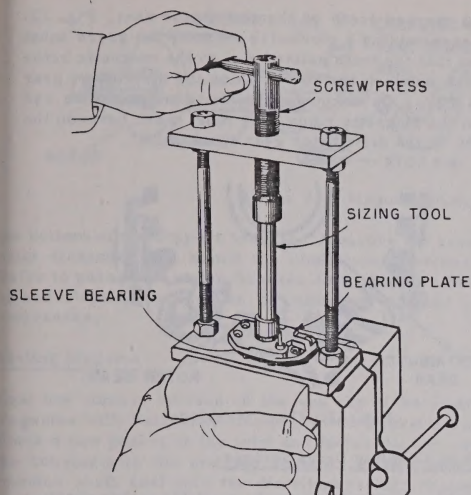


Fig. 18. Pressing Sleeve Bearing into Bearing Support

Petroleum solvent. Then dry the housing thoroughly before reassembling the magneto.

Replacement of Drive End Bearing

Types FM-X1, FM-X2, FM-X4, FM-XE4

The drive end ball bearing used in types FM-X1, FM-X2, FM-X4, and FM-XE4 magnetos, when cleaned, inspected, and repacked with FMCO11 magneto bearing grease, may be replaced in the housing, Fig. 17. Center the bearing by hand, in the housing, and place the housing in the screw press. Place the bearing above the support block carefully centering it with the bearing. Then turn down the drive screw of the press, placing the brass cap between the drive screw and the support block. Be sure the assembly is perpendicular in the press before forcing the bearing into the housing. Replace the magnetic rotor drive end bearing snap ring.

Replacement of Sleeve Bearings

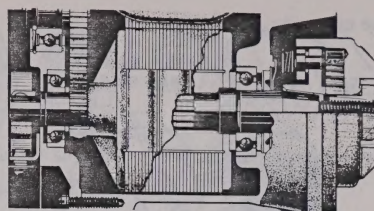
Push the new sleeve bearing on the end of tool TD2252A and place the bearing support plate and tool in the 370TD hand screw press in the same position as for removal, Fig. 18. Apply an even, gradual pressure, pushing the bearing into the bearing support until it is flush with the breaker side of the plate. When both the magnetic rotor bearing and the distributor bearing in types FM-XF2, FM-X4, and FM-XE4 magnetos have been replaced, the bearing support is ready to be replaced in the housing.

Press the distributor ball bearing into its recess, types FM-E, FM-XR, FM-XOR, using the 370TD press, and replace the distributor bearing snap ring. Then press the distributor shaft into place using the hand press, and replace the distributor shaft snap ring. The bearing support is ready to be replaced in the housing.

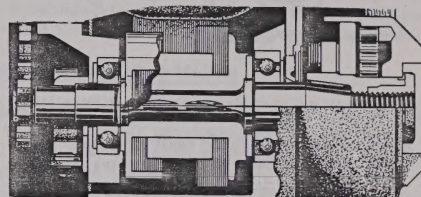
Reassembly of Magnetic Rotor

Types FM-XV, FM-XOR, FM-E

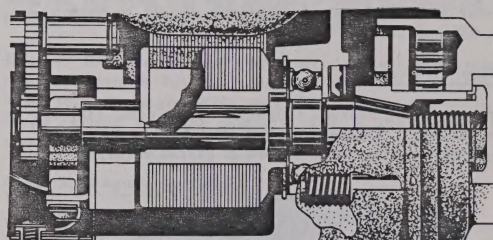
Place a new magnetic rotor bearing oil seal in the drive end recess of the rotor, and a new magnetic rotor seal



Two-pole Rotor with Perpendicular Bar Magnets



Four-pole Rotor with Cylindrical Magnet



Two-pole Rotor with Block Magnets

Fig. 19. Three Types Magnetic Rotors Assembled in Housing

in the cam end recess of the rotor for type FM-XV magnetos, Fig. 19. Slide the bearing thrust washer next to the magnetic rotor gear on rotors for types FM-XR, FM-XOR, and FM-E magnetos. Place the assembly in the hand screw press and with the rotor accurately aligned with the bearing race, press the inner bearing race onto the rotor using the inner race driver OMT82 as an auxiliary tool. Press the bearing race for the drive end bearing of types FM-XR, FM-XOR, and FM-E magnetos onto the rotor until it reaches the shoulder of the lamination assembly. Press the races for the other bearings onto the rotor as far as the washers and cork seals will permit. Place the ball retainer on the inner bearing races and replace the rotor and bearing into the housing.

Replacement of Magnetic Rotor into Housing

Types FM-X1, FM-X2, FM-X4

The magnetic rotor types FM-X1, FM-X2, FM-XF2 and FM-XE4 magnetos must be pressed into the housing, Fig. 20, using the 370TD screw press. Place housing in the press with the drive end bearing accurately centered over the large hole in base plate. Then, with brass cap over cam end of the rotor, press the rotor into the bearing until the shoulder of the lamination assembly touches the inner race of drive end bearing. Replace the rotor drive end shaft snap ring in its groove on

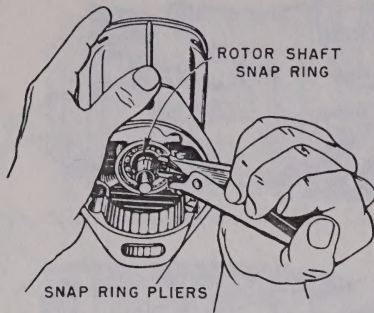


Fig. 20. Replacing Rotor Drive End Shaft Snap Ring

the rotor shaft; replace the rotor shaft seal inner washer, rotor shaft seal and rotor shaft seal outer washer.

When replacing the magnetic rotor on the FM-O, FM-XO, FM-XOR, FM-XY, FM-XV and all magnetos with three piece ball bearings, end end play tolerance of the magnetic rotor between its bearings should be held below 0.007 inches.

Coil Replacement

Before replacing bearing support, set the coil, Fig. 21, in the housing. Tighten the two coil bridge setscrews and seal them with a drop or two of gasket varnish.

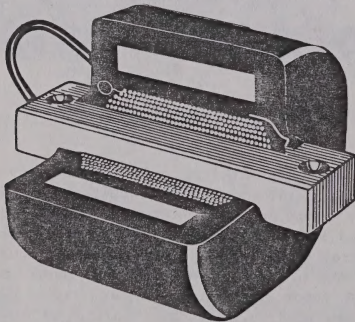


Fig. 21. Cutaway of Molded Coil

Replacement of Bearing Support Assembly and Internal Timing

Replace the distributor shaft and gear assembly in the bearing support of types FM-XF2, FM-X4, and FM-XE4 magnetos and secure it in place with the distributor shaft snap ring. Fasten the bearing support assembly in the housing. Replace the magnetic rotor gear pin and magnetic rotor gear. The former can be tapped into position by placing a hollow cylindrical tool, such as the OMT82, over the cam end of the rotor with the gear partially in place, and striking the cylindrical tool a few light taps. On later model magnetos the new type magnetic rotor can be easily assembled on the cam end of the magnetic rotor without special tools. A snap ring holds this gear onto the shaft. Care must be exercised in meshing the marked teeth of the magnetic rotor gear

with the marked teeth of the distributor gear, Fig. 22. when reassembling a clockwise magneto the gears must mesh so that the tooth painted red on the magnetic rotor will mesh between the two teeth on the distributor gear marked "C". On a counterclockwise magneto the red tooth on the magnetic rotor gear must mesh between the two teeth on the distributor gear marked "A".

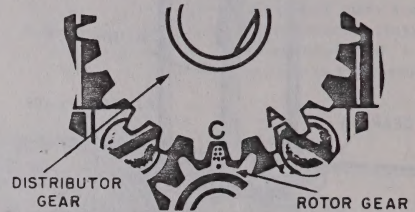


Fig. 22. Gear Markings

Rotation of Coupling Drive Springs

The coupling drive spring can be used for either rotation by simply turning it over. Care must be taken to place the spring correctly in the shell, since incorrect assembly will damage the inside anchor end. Fig. 23. illustrates the correct location of drive springs in series U coupling shells. Catch the inner end of the drive spring in the longer slot of the coupling hub and complete the assembly by winding the drive spring one full turn. Push the assembly together and key the coupling onto the rotor shaft. Replace the impulse coupling nut lockwasher, screw the impulse coupling nut into place, and turn up the lugs on the impulse coupling nut lockwasher, or replace the coupling nut lockwire, if used.

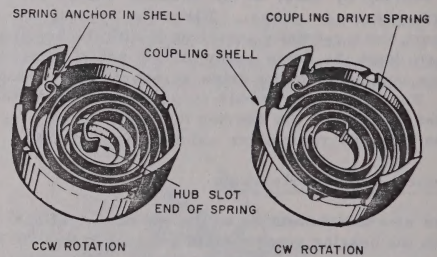


Fig. 23. Position of Drive Spring in Coupling Shell

Assembly of Breaker Mechanism

Remount the condenser on the bearing support. On type FM-XV magnetos the cam wick and holder assembly is mounted on the condenser mounting screw, along with the condenser. On all other magnetos except those with feed-thru condensers the cam wick and holder assembly is supported by the No. 8 contact support locking screw. Remount the breaker arm support bracket by means of the two support bracket locking screws, lockwashers, and flat washers. Slide the arm onto the fulcrum pin and replace the fulcrum pin snap ring.

Place the lead wire terminal from the coil, the terminal from the condenser, the terminal from the ground switch, and the end of the breaker arm spring onto the breaker arm terminal screw, and fasten this screw in

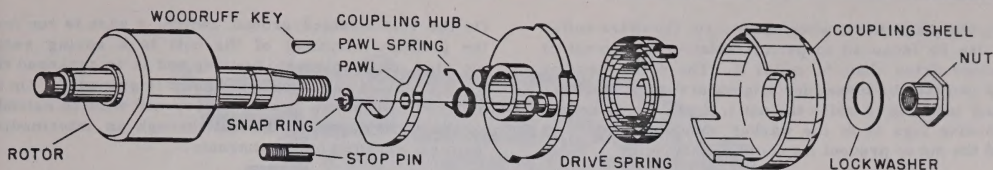


Fig. 24. Magnetic Rotor and Disassembled Impulse Coupling

the bottom of the support bracket. Measure the breaker point clearance and adjust the clearance if necessary. Refer to paragraph under Breaker Arm, Support Bracket and Points, for details on adjusting breaker point clearances.

Sealing Magneto

Coat the contact surface of the end cap of the standard magnetos with Fairbanks Morse FMCO2 Gasket Varnish. Place a new gasket in the joint and fasten the end cap on the housing with the end cap screws. Push a new distributor shaft seal into the distributor shaft recess in the end cap of types FM-X4, FM-XF2, FM-XR, FM-XOR and FM-XV4B7 magnetos. Replace the distributor rotor on the end of the distributor shaft, pushing it into place as far as it will go. Then replace the end cap cover using a new gasket.

TIMING MAGNETO TO ENGINE

Accurate timing of the magneto to the engine produces an ignition spark in each cylinder at the exact instant the fuel mixture should be ignited for best engine performance. This instant, which is determined by the engine manufacturer, is designated as a given number of degrees of angular travel of the crankshaft before the piston reaches inner dead center on the compression stroke. When starting the engine, it is advisable to retard the ignition spark until it occurs late enough in the cycle to avoid backfiring. Impulse couplings when used with magnetos automatically provide this spark retarding feature while the engine is being started.

The importance of correctly timing the magneto to the engine cannot be overemphasized, and the steps described below should be followed carefully. Either the advanced spark position method or the impulse coupling trip method may be used. Whichever method is used, the breaker points must first be accurately adjusted to secure proper timing of the ignition spark.

Advance Spark Position Method

Magneto: Set the magneto for advance spark position in the No. 1 cylinder. This is done by turning the rotor from the coupling end in the direction opposite to normal rotation until the distributor contact lines up exactly with the timing boss. With certain exceptions the No. 1 outlet on four-cylinder magnetos is the upper left of the four terminals. On type FM-XOR six-cylinder magnetos the No. 1 cylinder outlet is usually diagonally upward, 30° to the left of vertical. When the magneto is timed for advance spark in the No. 1 cylinder, it should be held exactly in the position until coupled to the engine.

Engine: Engine builders usually indicate by marks on the flywheel and flywheel housing, the position of the engine for advance spark timing. Refer to the engine manufacturer's instruction book for details concerning timing

marks on your particular engine. Then rotate the crankshaft until the timing marks coincide, indicating that the No. 1 cylinder is in advance-spark firing position. Be sure that the piston is on its compression stroke.

Impulse Coupling Trip Method

Magneto: Remount the end cap cover on the end cap. Set the magneto for spark discharge to the No. 1 terminal. This may be accomplished by use of a stiff, short length of wire placed in the No. 1 socket and bent to within 1/8 in. of the magneto frame. Then turn the magnetic rotor from the impulse coupling end in its normal direction of rotation until a spark is observed between the wire and the housing. Hold the coupling in the position in which the trip occurred.

Engine: Remove the spark plug, or otherwise determine top dead center for the piston in the No. 1 cylinder. Then turn the engine over until this position is reached, being certain that the piston is just at the end of its compression stroke.

Coupling Magneto to Engine

Without disturbing the setting of either magneto or engine as determined by the methods above, couple the engine in the following manner

Flange Mounting Magnetos: Engage the drive lugs of the impulse coupling with the driving slots of the engine drive member. A slight movement of the engine flywheel may be necessary to secure accurate alignment. Tighten capscrews and nuts securely.

Base Mounting Magnetos: If no change has been made in the position of the member, it is necessary only to engage the drive lugs of the impulse coupling with the drive slots of the float disc. Be sure that the shaft assembly is properly aligned before securing the base mounting screws.

Adjustable Drive Members

Most engines using base mounting magnetos are equipped with adjustable drive members, Fig. 25. Ordinarily the position of the drive member is not altered when re-

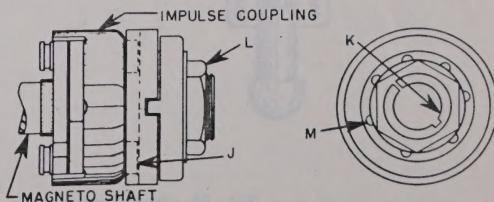


Fig. 25. Adjustable Drive Member

moving the magneto but when necessary, the drive collar nut L can be loosened to permit relative movement of the engine drive shaft in collar K. The drive member slots J can then be turned for alignment with the impulse coupling lugs, after which the nut L should be tightened. The locking lugs M of the washer should be turned up around the nut to prevent its coming loose.

Primary Ground Switches

Engines may be stopped by shutting off the fuel supply or grounding out the magneto ignition circuit. Shutting off the fuel supply has the disadvantage of not stopping the engine quickly, while grounding the ignition circuit stops the engine at once.

Battery ignition systems must be opened to stop the engine while in magneto ignition systems the ignition circuit must be grounded to stop the engine.

Primary ground switches must be located in the primary circuit of either type magneto, Fig. 26. The action is instantaneous and fuel is left in the fuel system for immediate starting.

There are many types or styles of ground switches, but in general they may be divided into two groups, those located on the unit and those located away from the unit.

On the self-mounted ground switch, a wire is run from the primary terminal of the coil to a spring switch mounted on the magneto housing and is so arranged that when operated the primary circuit is grounded. On the mounted switch the same primary coil wire is extended to the control panel, usually through an intermediate terminal mounted on the magneto.

When stopping the engine by grounding out the primary circuit, the switch must be kept closed until the engine stops.

Radio Shielded Magnetos

The high voltage spark discharge, which provides ignition for the engine, often causes interference in radio reception. Frequently it is necessary or desirable to eliminate this interference, Fig. 27. In principle, the radio shielding of a magneto requires the replacement of the plastic end cap by an all metal end cap with an insulated plastic distributor block mounted inside. Special outlets are provided for the metal encased high tension cables, and the spark plugs are metal covered. All this exterior metal housing is interconnected and grounded to function as a shield and absorb the interference causing waves. On certain magnetos for military applications the primary ground terminal is located on the end of the feed-thru condenser or on the end of the primary circuit connector.

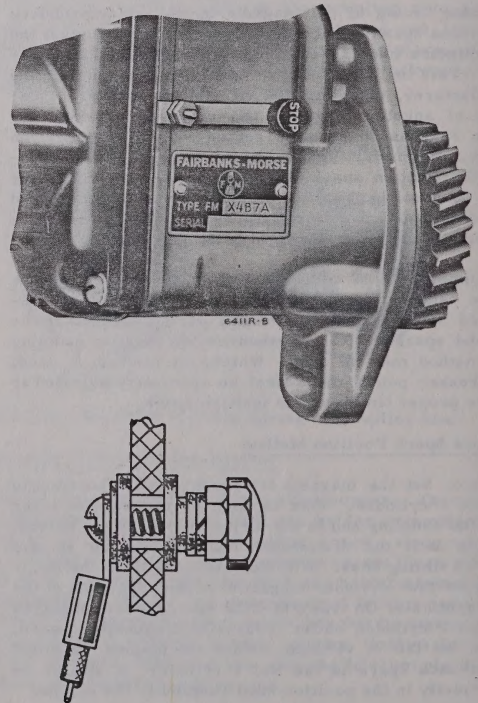
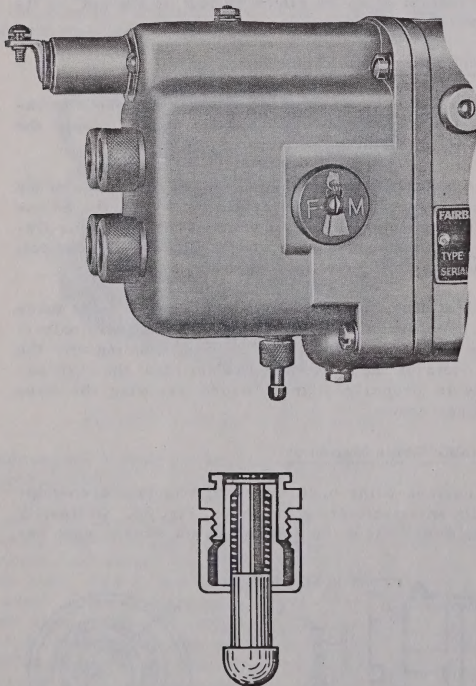


Fig. 26. Push-button and Lever Type Type Ground Switches

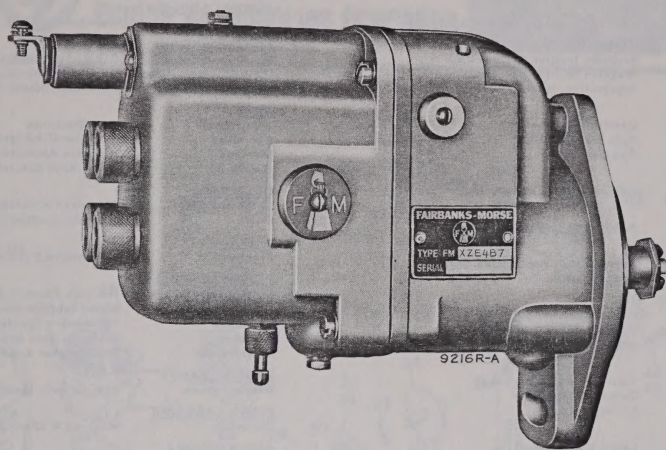
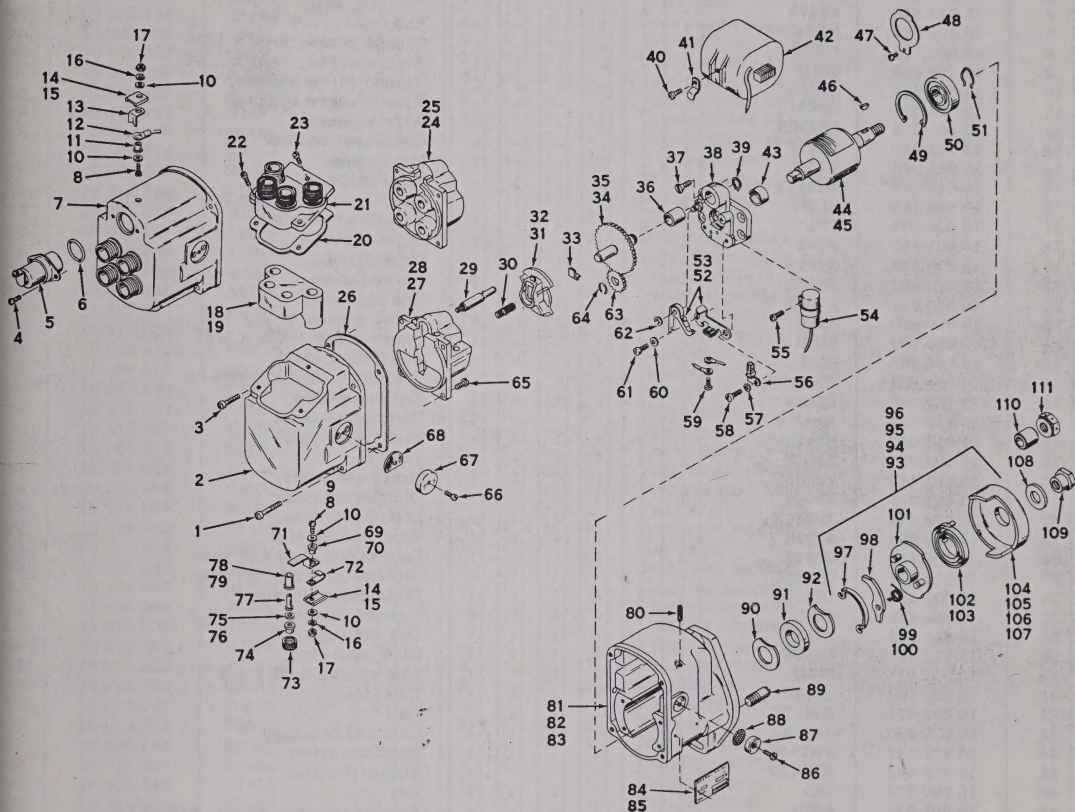


Fig. 27. Complete Radio Shielded Magneto

CENTRAL DISTRIBUTORS - ACCESSORIES

ALABAMA Birmingham	Birmingham Electric Battery Co.	NEW YORK Buffalo Jamaica Woodside, L.I. East Amherst	Hettrich Electric Service John Reiner & Co. Broadway Ignition Co., Inc. Chuck's Cart Sales
ALASKA Seattle	Hatch & Kirk, Inc.	NORTH CAROLINA Charlotte	Automotive Elec. Associates, Inc.
ARIZONA Phoenix	Charlie C. Jones Battery & Elec. Co.	NORTH DAKOTA St. Paul, Minn. West St. Paul, Minn. Columbus, Ohio	Diesel Service Co. Carl A. Anderson, Inc. Columbus Diesel Supply Co.
ARKANSAS Shreveport, La. Tulsa, Okla. Memphis, Tenn.	Magneto Ignition Service Co. Magneto Ignition Co., Inc. Automotive Electric Service Co. Inc.	OHIO Walbridge, Cleveland Marietta Cincinnati	V. E. Petersen The Cleveland Ignition Co. Marietta Automotive Warehouse J & N Auto Electric
CALIFORNIA Los Angeles San Francisco San Diego	Pacific Equipment Co. H. G. Makelim Co. Pee Gee Parts	OKLAHOMA Oklahoma City Tulsa	American Electric Ignition Co. Magneto Ignition Co., Inc.
COLORADO Denver	Central Motive Power, Inc.	OREGON Portland	Automotive Products, Inc.
CONNECTICUT Boston, Mass.	A. & J. Auto Ignition Co.	PENNSYLVANIA Buffalo, N. Y. Philadelphia Pittsburgh Scranton Philadelphia	Hettrich Electric Service Motor Ignition Co. Automotive Ignition Co. Scranton Auto Ignition Co. Philadelphia Engine, Inc.
DELAWARE Baltimore, Md. Philadelphia, Pa.	Parks & Hull Automotive Corp. Motor Ignition Co.	RHODE ISLAND Boston, Mass.	A. & J. Auto Ignition Co.
FLORIDA Fort White Miami Orlando	Paul Hunter Electric Sales & Service Interstate Diesel Service	SOUTH CAROLINA Columbia	Magneto & Elec. Service In.
GEORGIA Atlanta Swainsboro Atlanta	Auto Electric & Diesel Co. Dealers Supply Co. Stovall & Co.	SOUTH DAKOTA Omaha, Nebr. St. Paul, Minn. West St. Paul, Minn.	Carl A. Anderson, Inc. Diesel Service Co. Carl A. Anderson, Inc.
HAWAII Honolulu	Lanco Engine Services	TENNESSEE Atlanta, Ga. Memphis Nashville	Auto Electric & Magneto Co. Automotive Elec. Service Co., Inc. Automobile Electric Service Co.
IDAHO Seattle, Wash.	Hatch & Kirk, Inc.	TEXAS Amarillo Dallas Dallas El Paso Fort Worth Houston Kilgore San Antonio McAllen	Wilson Battery & Electric Co. The Grayson Co. The Motor Mart Spitzer A & I Products McCoy Sales & Service Wahlberg-McCreary, Inc. Magneto Sales & Service Co. S. X. Callahan Hoff Parts and Service
ILLINOIS Elmhurst Elmhurst Maryland Heights	Illinois Auto Electric Co. Midwest Engine Warehouse Electrical Parts & Service Co.	UTAH Salt Lake City	Diesel Electric Service & Supply
INDIANA Indianapolis South Bend	Eagle Machine Company Michiana Midget Motors	VERMONT Boston, Mass.	A. & J. Auto Ignition Co.
IOWA Des Moines Des Moines Omaha, Nebr.	Electrical Sales & Service Co. Magneto, Carburetor & Electric Co. Carl A. Anderson, Inc.	VIRGINIA Baltimore, Md. Bluefield, W. Va Norfolk	Parks & Hull Automotive Corp. Groseclose Auto Electrical Service Diesel Injection Sales & Service
KANSAS Kansas City, Mo. Amarillo, Texas	Electrical & Magneto Service Co. Inc. Wilson Battery & Electric Co.	WASHINGTON Seattle	Hatch & Kirk, Inc.
KENTUCKY Louisville Memphis, Tenn.	Ellingsworth Auto Electric Co. Automotive Elec. Service Co. Inc.	WEST VIRGINIA Baltimore, Md. Bluefield Pittsburgh, Pa.	Parks & Hull Automotive Corp. Groseclose Auto Electrical Service Automotive Ignition Co.
LOUISIANA New Orleans Shreveport	John M. Walton, Inc. Magneto Ignition Service Co.	WISCONSIN Milwaukee St. Paul, Minn. West St. Paul, Minn.	Wisconsin Magneto Co. Diesel Service Co. Carl A. Anderson, Inc.
MAINE Boston, Mass.	A. & J. Auto Ignition Co.	WYOMING Denver, Colo. Billings, Mont.	Central Motive Power, Inc. Original Equipment Co.
MARYLAND Baltimore	Parks & Hull Automotive Corp.	EXPORT Colt Industries Engine Accessories Operation Beloit, Wisconsin	MEXICO Overseas, S. A.
MASSACHUSETTS Boston	A. & J. Auto Ignition Co.	ALBERTA Calgary Edmonton	CANADA Hutton's, Ltd. Loveseth, Ltd.
MICHIGAN Detroit Milwaukee, Wis.	Auto Electric & Service Corp. Wisconsin Magneto Co.	BRITISH COLUMBIA Vancouver	Magneto Sales & Service, Ltd.
MINNESOTA St. Paul West St. Paul	Diesel Service Co. Carl A. Anderson, Inc.	MANITOBA Winnipeg	Auto Elec. Service (Western) Ltd.
MISSISSIPPI New Orleans, La. Memphis, Tenn. Tupelo	John M. Walton, Inc. Automotive Elect. Service Co., Inc. The Wright Company	ONTARIO Toronto Winnipeg, Manitoba	Auto Electric Service Co., Ltd. Auto Elec. Service (Western), Ltd.
MISSOURI Maryland Heights Kansas City Memphis, Tenn.	Electric Parts & Service Co. Electrical & Magneto Serv. Inc. Automotive Elec. Service Co., Inc.	SASKATCHEWAN Regina Saskatoon	Electric Motor Service Lambert Electric, Ltd.
MONTANA Billings Seattle, Wash.	Original Equipment Co. Hatch & Kirk, Inc.		
NEBRASKA Denver, Colo Omaha	Central Motive Power, Inc. Carl A. Anderson, Inc.		
NEVADA Los Angeles, Calif. San Francisco, Calif. San Diego	Pacific Equipment Co. H. G. Makelim Co. Pee Gee Parts		
NEW HAMPSHIRE Boston, Mass.	A. & J. Auto Ignition Co.		
NEW JERSEY Philadelphia, Pa.	Motor Ignition Co.		
NEW MEXICO Denver, Colo.	Central Motive Power, Inc.		



DATA		FM XE4B 16V	FM XE4B 16W	FM XE4B 16Y	FM XE4B 17	FM XE4B 17A	FM XE4B 17B	MAGNETO PART NUMBERS	
Rotation		CW	CW	CW	CW	CW	CW		
Impulse Coupling		UB	UB	UB	UB	UB	UB		
Lag Angle		25°	20°	20°	45°	35°	35°		
Engine Manufacturer and Specification Number	Continental Motor Corp.	X	-	-	-	-	-	FMXE4B16V	10 004 476
	Continental Motor Corp. - F162M448	-	X	-	-	-	-	FMXE4B16W	10 004 484
	Continental Motor Corp. - Y69M422	-	-	X	-	-	-	FMXE4B16Y	10 004 499
	Buda Div. - Allis Chalmers Mfg. Co.	-	-	-	X	-	-	FMXE4B17	10 006 465
	Buda Div. - Allis Chalmers Mfg. Co.	-	-	-	-	X	-	FMXE4B17A	10 006 490
	Buda Div. - Allis Chalmers Mfg. Co.	-	-	-	-	-	X	FMXE4B17B	10 010 430
Ref. No.	Part Number	Port Number	Number Used					Description	
1	10 001 730	10S18D	2	2	2	2	2	End cap screw, 10-24 x 1-1/8	
2	10 001 038	HY2430	-	-	-	1	1	End cap	
3	10 000 894	10S12D	2	2	2	2	2	End cap screw, 10-24 x 3/4	
4	10 000 882	6S6D	2	2	2	-	-	Condenser screw, 6-32 x 3/8	

Ref. No.	Part Number	Part Number	Number Used							Description
5	10 003 596	MX2433	1	1	1	-	-	-	-	Feed-thru condenser .28-.35 μ fd
6	10 011 679	P2473	1	1	1	-	-	-	-	"O" ring seal
7	10 004 252	RX2430A	1	1	1	-	-	-	-	End cap
8	10 000 706	6S8N	2	2	2	-	-	-	-	Ground screw, 6-32 x 1/2
9	10 000 663	6S7N	-	-	-	1	1	1	1	Ground screw, 6-32 x 7/16
10	10 042 458	D2458	4	4	4	2	2	2	2	Ground screw washer, #6
11	10 122 457	H2457A	1	1	1	-	-	-	-	Ground screw bushing
12	10 004 238	K2499A	1	1	1	-	-	-	-	Wire assembly
13	10 003 058	K2513	1	1	1	-	-	-	-	Condenser contact
14	10 021 355	B1355	2	-	2	-	-	-	1	Strip guide
15	10 010 041	B1355X	-	2	-	1	1	-	-	Strip guide
16	10 000 768	6LW1	2	2	2	1	1	1	1	Ground screw lockwasher
17	10 000 350	6N1	2	2	2	1	1	1	1	Ground screw nut
18	10 001 952	A799	-	-	-	-	-	-	1	Guide block
19	10 010 038	A799X	-	-	-	1	1	-	-	Guide block
20	10 080 682	B682A	-	-	-	1	1	1	1	Cover gasket
21	10 310 800	A800A	-	-	-	1	1	1	1	End cap cover
22	10 000 890	8S8D	-	-	-	2	2	2	2	Cover screw, 8-32 x 1/2
23	10 000 889	8S6D	-	-	-	1	1	1	1	Cover screw, 8-32 x 3/8
24	10 003 958	J2474E	1	-	1	-	-	-	-	Distributor block
25	10 014 068	J2474EX	-	1	-	-	-	-	-	Distributor block
26	10 102 498	K2498	1	1	1	1	1	1	1	End cap gasket
27	10 102 474	B2474E	-	-	-	-	-	-	1	Distributor block
28	10 010 044	B2474EX	-	-	-	1	1	-	-	Distributor block
29	10 003 036	B983B	1	1	1	1	1	1	1	Lead rod
30	10 052 460	E2460B	1	1	1	1	1	1	1	Brush and spring
31	10 010 748	X2765	1	-	1	-	-	-	1	Distributor rotor
32	10 010 749	X2765X	-	1	-	1	1	-	-	Distributor rotor
33	10 000 659	A2766	1	1	1	1	1	1	1	Rotor spring clip
34	10 155 939	Q5939	1	-	1	-	-	-	1	Distributor shaft and gear
35	10 010 084	Q5939X	-	1	-	1	1	-	-	Distributor shaft and gear
36	10 095 950	D5950C	1	1	1	1	1	1	1	Distributor bearing
37	10 000 668	8S6G	4	4	4	4	4	4	4	Support screw, 8-32 x 3/8
38	10 224 631	X4631	1	1	1	1	1	1	1	Bearing support
39	10 071 498	G1498	1	1	1	1	1	1	1	Shaft snap ring
40	10 001 818	6S4U	1	1	1	1	1	1	1	Clip screw, 6-32 x 1/4
41	10 001 742	B6120	1	1	1	1	1	1	1	Coil clip
42	10 362 477	R2477C	1	1	1	1	1	1	1	Coil
43	10 025 950	A5950A	1	1	1	1	1	1	1	Cam end bearing
44	10 372 481	JW2480	-	1	1	1	1	1	1	Magnetic rotor
45	10 472 481	RN2480	1	-	-	-	-	-	-	Magnetic rotor
46	10 000 379	3K1	1	1	1	1	1	1	1	Key
47	10 001 930	8S6U	-	-	1	-	-	-	-	Retainer washer screw, 8-32 x 1/2
48	10 003 944	A2492D	-	-	1	-	-	-	-	Bearing retainer washer
49	10 101 498	B1498B	1	1	-	1	1	1	1	Bearing snap ring
50	10 105 949	C5949	1	1	1	1	1	1	1	Drive end bearing
51	10 131 498	B1498D	1	1	1	1	1	1	1	Shaft snap ring
52	10 412 437	A2437A	1	-	1	-	-	-	1	Point set
53	10 010 570	A2437AX	-	1	-	1	1	-	-	Point set
54	10 010 215	SXY2433	-	-	-	1	1	1	1	Condenser .28-.36 μ fd
55	10 013 062	8S5NA	-	-	-	1	1	1	1	Condenser screw, 8-32 x 5/16
56	10 072 788	G2788	1	1	1	1	1	1	1	Cam wick
57	10 025 909	B5969	1	1	1	1	1	1	1	Support screw washer, #8
58	10 001 930	8S6U	1	1	1	1	1	1	1	Support screw, 8-32 x 3/8
59	10 011 694	6S6Z	1	1	1	1	1	1	1	Terminal screw, 6-32 x 3/8
60	10 042 458	D2458	1	1	1	1	1	1	1	Support screw washer, #6
61	10 004 028	6S6U	1	1	1	1	1	1	1	Support screw, 6-32 x 3/8
62	10 011 884	C1498G	1	1	1	1	1	1	1	Fulcrum pin snap ring

(Continued on Page 3)

Ref. No.	Part Number	Part Number	Number Used							Description
(Continued from Page 2)										
63	10 010 360	Q5952	1	1	1	1	1	1	1	Rotor gear
64	10 041 498	D1498	1	1	1	1	1	1	1	Gear snap ring
65	10 000 890	8S8D	4	4	4	4	4	4	4	Block screw, 8-32 x 1/2
66	10 000 662	6S6N	2	2	2	2	2	2	2	Cover screw, 6-32 x 3/8
67	10 011 232	A1232	2	2	2	2	2	2	2	Vent cover - end cap
68	10 036 032	A6032A	2	2	2	2	2	2	2	Vent screen - end cap
69	10 112 457	G2457A	1	-	1	-	-	-	1	Ground screw bushing
70	10 010 042	G2457AX	-	1	-	1	1	-	-	Ground screw bushing
71	10 082 514	H2514	-	-	-	1	1	1	-	Condenser contact
72	10 004 399	Z2514	1	1	1	1	1	1	1	Primary ground to contact support
73	10 022 735	A2735A	-	-	-	1	1	1	1	Ground terminal nut
74	10 021 077	B1077	-	-	-	1	1	1	-	Cable ferrule
75	10 016 018	A6018	-	-	-	-	-	-	1	Insulating washer
76	10 010 039	A6018X	-	-	-	1	1	-	-	Insulating washer
77	10 013 969	A3969	-	-	-	1	1	1	1	Ground cable terminal
78	10 011 166	A1166	-	-	-	-	-	-	1	Terminal insulator
79	10 010 043	A1166X	-	-	-	1	1	-	-	Terminal insulator
80	10 010 938	31SS14A	2	2	2	2	2	2	2	Coil setscrew, 5/16-20 x 7/8
81	10 003 912	PW2425	1	-	-	-	-	-	-	Housing
82	10 003 541	QW2425	-	1	1	-	-	-	-	Housing
83	10 003 539	TZ2425	-	-	-	1	1	1	1	Housing
84	10 010 195	A195	1	1	-	1	1	1	1	Name plate
85	10 011 783	K195	-	-	1	-	-	-	-	Name plate
86	10 001 818	6S4U	2	2	2	2	2	2	2	Cover screw, 6-32 x 1/4
87	10 004 099	B6030A	2	2	2	2	2	2	2	Vent cover - housing
88	10 003 564	C6032B	2	2	2	2	2	2	2	Vent screen - housing
89	10 172 568	S2568	1	1	1	1	1	1	1	Pawl stop pin
90	10 112 492	A2492C	1	1	1	1	1	1	1	Seal inner washer
91	10 073 861	G3861	1	1	1	1	1	1	1	Shaft seal
92	10 012 492	A2492A	1	1	1	1	1	1	1	Seal outer washer
93	10 172 562	S2563C	-	-	-	1	-	-	1	Coupling complete
94	15 652 564	BZ2563C	-	1	1	-	-	-	-	Coupling complete
95	15 612 564	HZ2563C	1	-	-	-	-	-	-	Coupling complete
96	15 572 564	RZ2563C	-	-	-	-	1	-	-	Coupling complete
97	10 013 586	A1498J	1	1	1	1	1	1	1	Pawl lock spring
98	10 001 360	Q2566	2	2	2	2	2	2	2	Coupling pawl
99	10 013 242	S5963	2	-	-	-	-	-	-	Pawl spring
100	10 013 543	T5963	-	2	2	2	2	2	2	Pawl spring
101	10 172 563	S2563	1	1	1	1	1	1	1	Hub assembly
102	10 042 565	D2565	-	-	-	1	-	-	-	Coupling spring
103	10 052 565	E2565	1	1	1	-	1	1	1	Coupling spring
104	10 135 957	N5957	-	-	-	1	-	-	1	Coupling shell
105	10 235 957	Y5957	-	-	-	-	1	-	-	Coupling shell
106	10 295 957	EX5957	-	1	1	-	-	-	-	Coupling shell
107	15 515 957	DY5957	1	-	-	-	-	-	-	Coupling shell
108	10 011 781	B5931B	-	1	1	1	1	1	1	Coupling nut lockwasher
109	10 011 740	U2570	-	1	1	1	1	1	1	Coupling nut
110	10 072 572	G2572	1	-	-	-	-	-	-	Gear bushing
111	10 162 570	R2570	1	-	-	-	-	-	-	Coupling nut

Parts with number ending in "X" are fungus treated.



Colt Industries

INSTRUCTIONS
TYPE FM-E, X, Z
MAGNETOS

ENGINE ACCESSORIES OPERATION • BELOIT, WISCONSIN 53511

SERVICE INSTRUCTIONS

TYPE FM-E, FM-X, FM-XD, FM-XDE, FM-XE, FM-XF, FM-XFE, FM-XFZ, FM-XO, FM-XOR, FM-XR, FM-XV, FM-XVE, FM-XY, FM-XYE, FM-XZ, FM-XZE, FM-Z AND FM-ZE MAGNETOS

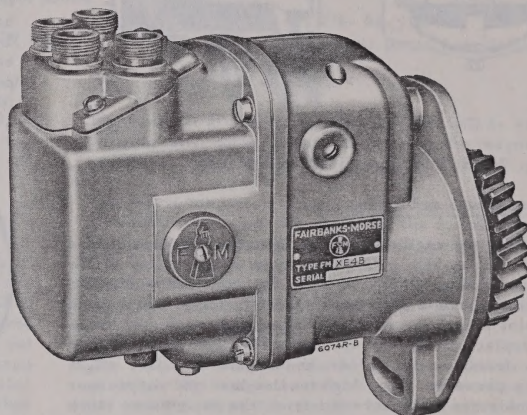
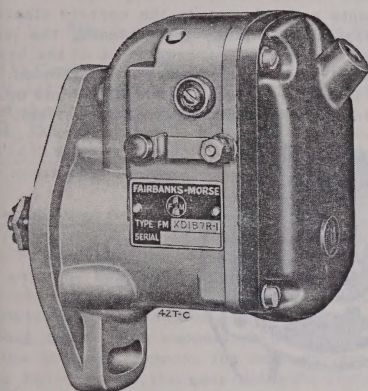


Fig. 1. Standard and Radio Shielded Magnetos

GENERAL DESCRIPTION

Fairbanks Morse Series X magnetos, Fig. 1, are of the rotating magnet design, the basic principle consisting of inducing and continually reversing magnetic flux lines thru an induction coil. This is accomplished by rapidly rotating the permanent magnetic rotor through a stationary field which is the basis of the magnetic circuit.

A one, two, or four-lobe cam actuates a breaker mechanism periodically during each revolution of the rotor. Each time the breaker points are separated by the magnetic rotor cam, an ignition spark is produced. In the one-cylinder magnetos this occurs once per revolution of the rotor. In the two-cylinder magnetos the distributor rotor forms an axial extension of the magnetic rotor and the breaker points are separated twice per revolution of the rotor by a two-lobe cam. Similarly, in the type FM-XV four-pole magnetos, the distributor rotor forms an axial extension of the magnetic rotor. Since the cam of the rotor has four lobes, the breaker points separate four times per revolution producing four ignition sparks. In the standard four-cylinder magnetos, a two-lobe cam is used which produces two ignition sparks per revolution of the magnetic rotor. In all such cases an ignition spark is furnished to each high tension outlet, once for every two revolutions of the magnetic rotor.

In the FM-XR6 and FMZ6 six-cylinder magnetos, a two-lobe cam is used which produces two ignition sparks per revolution of the magnetic rotor. A gear arrangement is used to connect the magnetic rotor with the distributor rotor which furnishes a spark to each high tension outlet once for every three revolutions of the magnetic rotor.

MAGNETO INSPECTION

The entire magneto should be inspected for worn parts every 1000 hours of operation.

End Cap and End Cap Removal

When the usual inspection and spark tests indicate poor magneto performance, the end cap and end cap cover, Fig. 2, if used, should be removed. Tag the ignition cables to insure their proper replacement in the endcap; then remove each high-tension cable from its socket. In the type FM-E magnetos, the end cap cover must be removed to expose the high tension cable terminals before the lead wires can be removed. When removing the end cap of the types FM-X4, FM-XR, FM-XOR, and the FM-XV magnetos, the end cap cover must be removed and the distributor rotor taken off the end of the rotor shaft before the end cap can be removed.

FILE SECTIONS—TYPE FM-E, FM-X, FM-Z

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Instruction M3-1
Supersedes 3133 dated July, 1967
March, 1973

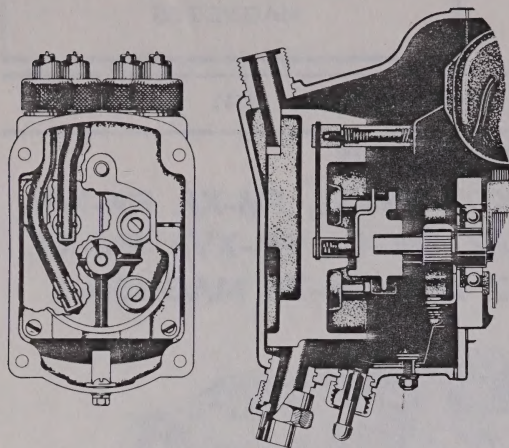


Fig. 2. End Cap and High Tension Cable Terminals

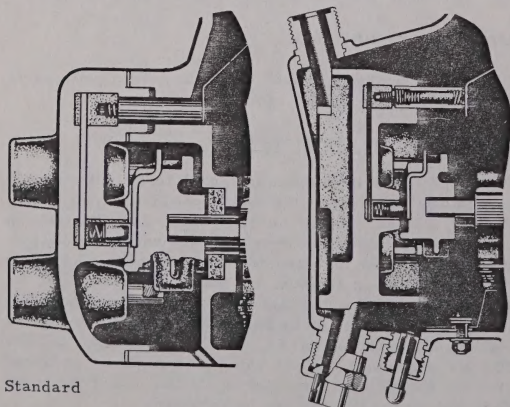
Carbon Brush and Spring

Magnetos for engines with two or more cylinders have a carbon brush and spring assembly in the center of the end cap cover, Fig. 3. Multi-cylinder radio-shielded magnetos have a distributor block in the end cap which contains a carbon brush and spring. Examine the brush and replace it if worn or damaged. The brush should move freely in its holder and should be under slight spring pressure. The high tension lead and suppressor assembly can be unscrewed from the distributor block for inspection, cleaning or replacement.

Breaker Arm, Support Bracket and Points

Breaker points should be checked and adjusted every 500 hours of operation.

To remove the breaker point assembly, Fig. 4, take out the breaker arm terminal screw which releases the coil lead wire, condenser lead, ground contact, and breaker



Standard

Radio Shielded with Distributor Block

Fig. 3. Magnetos with Brush and Spring

arm spring. Then slide off the fulcrum pin snap ring and lift the breaker arm off the fulcrum pin. Take out the two contact support locking screws, lockwashers and plate washers, and lift the support bracket from the bearing support.

Inspect the breaker points for pitting or pyramiding. A small tungsten file or fine stone should be used to resurface the points. If the points are badly worn or pitted they should be replaced. When the breaker points have been resurfaced or replaced be sure to adjust them to their proper clearance of 0.015 ± 0.002 in. at high point of cam. This adjustment is made in the following manner: Loosen the two contact support locking screws. Insert a screwdriver in the horizontal slot at the bottom of the contact support and move it by pivoting the tool between the two small bosses on the bearing support until the breaker points are adjusted to the correct clearance. Lock the assembly in place by tightening the locking screws; then take a final measurement of the breaker point gap after the locking screws are tightened. Oil film should be removed from the breaker points by using a brush and a small quantity of petroleum solvent.

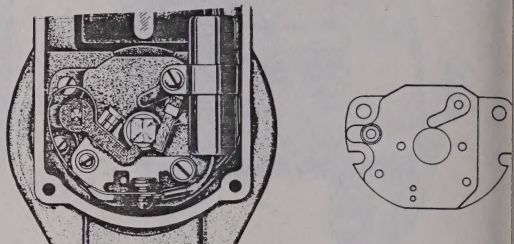


Fig. 4. Bearing Support with and without Point Set, Condenser and Cam Wick

Condenser

Remove the standard condenser from the magneto by unscrewing the condenser mounting screw, Fig. 5. To remove the feed-thru condensers on the FM-E6, FM-XE, FM-XFE, FM-XVE, FM-XYE and FM-XZE multiple cylinder radio-shielded magnetos, take out the two condenser mounting screws.

Clean the condenser and lead wire with a dry cloth; do not damage the lead wire. Then inspect lead wire for damage. Test the condenser for open circuit on a reliable condenser tester or substitute an identical new condenser in its place. The capacity of the AX-M-R-243 condenser is 0.17-0.23 mfd. The capacity of the S-X-Y

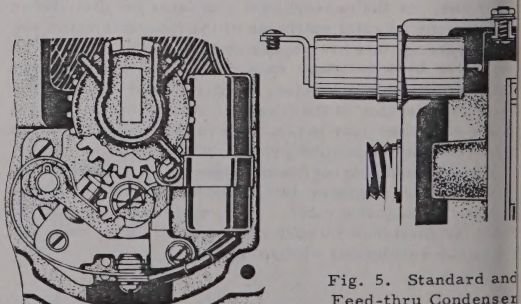


Fig. 5. Standard and Feed-thru Condenser

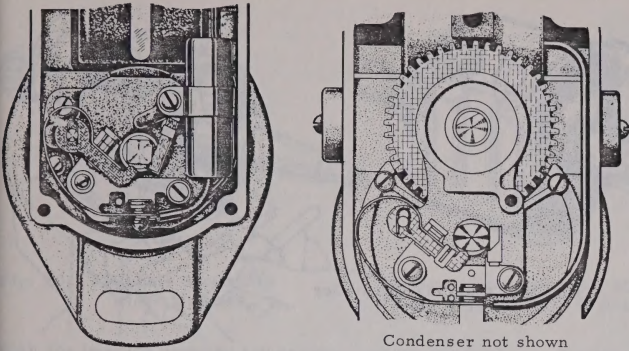


Fig. 6. Two Types of Bearing Supports, CW Rotation

-2433 Condenser is 0.28-0.36 mfd. The capacity of the L-V-2433 condenser is 0.37-0.43 mfd. The capacity of feed-thru condensers is as follows: HX2433 0.28-0.36 mfd, JX2433 0.17-0.23 mfd, KX2433 0.28-0.36 mfd and MX2433 0.28-0.35mfd. Test the condenser at 440v dc for breakdown voltage.

Bearing Support Assembly

Before removing the bearing support assembly, Fig. 6, be sure the breaker arm terminal screw has been removed. On types FM-X4, FM-XE4, FM-XF, FM-XFE, and FM-XZE, the magnetic rotor gear must be removed before the bearing support assembly can be taken out of the housing. Remove the magnetic rotor gear snap ring and draw off the gear using the pinion gear puller OMT76. The magnetic rotor gear pin can then be taken out. On later model magnetos the new style magnetic rotor gear Q5952 can be easily removed after taking off the rotor gear snap ring. Then take the bearing support out of the magneto housing.

On types FM-E, FM-XR and FM-XOR magnetos, if the bearing support is hard to get out, remove the impulse coupling on flange mounting magnetos, and lift out the oil slinger baffle disc, replace the impulse coupling nut on the rotor shaft, and strike the shaft a sharp blow. This will loosen the bearing support so it can be lifted out of the housing. The outer race of the rotor cam end bearing will remain in the bearing support.

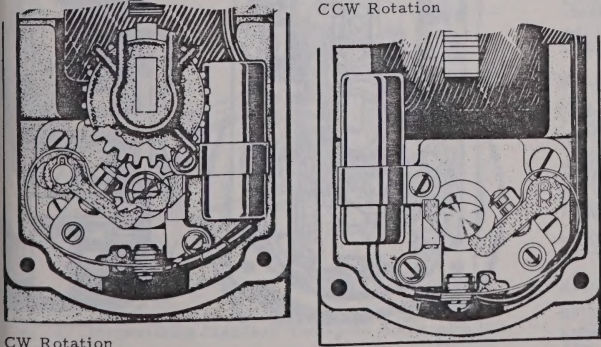


Fig. 7. Bearing Support with and without Distributor Gear

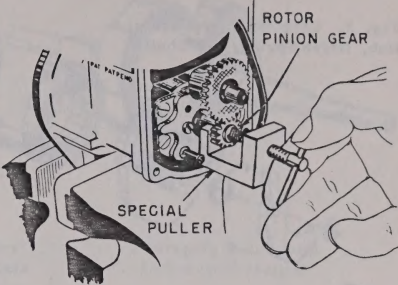


Fig. 6a. Use of
OMT76 Magnetic Rotor Gear Puller

Coil - All FM-X Magnetos

The removal of the coil in all magnetos will be easier if the magnetic rotor is turned to place the magnets in a vertical position or until the flux lock is broken.

The coil in magnetos which have no reduction gear, Fig. 7, between the magnetic rotor and the distributor rotor, can be easily removed for testing. Take out the breaker arm terminal screw, remove the coil lead wire and the condenser. Loosen the coil bridge setscrews located on top of the housing at each side, then slide the coil out of the housing.

The coil in a magneto which has the distributor rotor geared to the magnetic rotor can be removed only after the bearing support assembly has been taken out of the housing. Refer to paragraph Bearing Support Assembly.

Clean the coil lead wire with a dry cloth; do not damage the lead wire. Inspect the coil visually for cracks or exposed windings which would be cause for discarding the coil. Test the coil on a reliable tester.

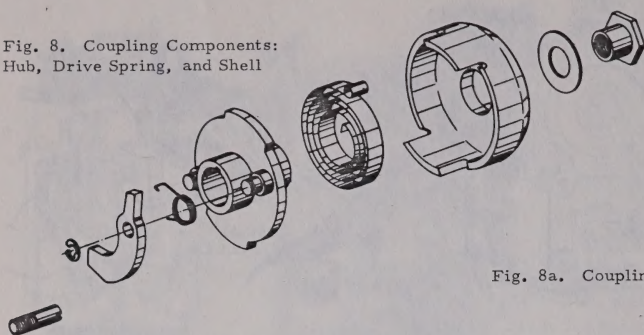
Impulse Coupling

Although much service work can be performed on the magneto without taking the impulse coupling off the rotor shaft, the removal of the magnetic rotor will necessitate complete removal of the coupling. We recommend that the coupling be removed for cleaning and lubrication whenever major service work is done on the magneto.

An impulse coupling is a mechanical device installed on the magnetic rotor shaft between the magneto and engine drive. Its prime purpose is to intensify the ignition spark at low rotative speed, and to automatically retard the ignition spark during the engine starting to eliminate backfire.

The impulse coupling assembly, Fig. 8, consists of a shell, flat or coiled drive spring and coupling hub assembly with or without pawl springs, which is keyed to the magnetic rotor shaft. The drive spring has one end engaged in the longer slot in the coupling hub while the other end has a loop formed which fits into the coupling shell. The coupling shell is fitted into the drive member on the engine drive shaft.

Fig. 8. Coupling Components:
Hub, Drive Spring, and Shell



When the engine is operating at slow speed, the pawl in the coupling hub engages the stop pin in the magneto housing, which prevents further movement of the magnetic rotor. As the engine continues to operate the shell winds up the drive spring. At the point in the engine cycle when the fuel mixture should be ignited, the pawl is released by movement of the coupling shell, and snaps the magnetic rotor forward at high speed through its firing cycle. As the engine speed increases, centrifugal force withdraws the pawls to a position where they no longer engage the stop pin.

In applications where the magneto operates in other than a horizontal position, the force of gravity cannot act upon the coupling pawls during the starting period. To cause the necessary engagement action, small wire springs are attached to each coupling pawl.

To remove the complete impulse coupling, take out the impulse coupling nut lockwire or turn down the lugs of the impulse coupling nut lockwasher; remove the impulse coupling nut and lockwasher. In the base mounted magnetos, remove the impulse outer shell screws, lift out the outer shell cupped washer and the outer shell felt washer.

Remove the complete impulse coupling from the magneto by using the OMT8 puller. If the tension applied by the puller does not loosen the coupling, tap the puller screw with a hammer, which will jar the coupling loose from the rotor shaft. When the coupling is removed, lift out the coupling outer shell flat washer used on base mounting magnetos. The coupling should be disassembled only by an experienced service station. In the event the shell comes loose from the hub when the coupling nut is taken off, care must be exercised in reassembly.

Place the coiled end of the coupling spring in the slot in the shell in the correct rotation for the magneto: clockwise for CW rotation, counterclockwise for CCW rotation viewed when the coupling shell is turned up. Engage the straight end of the spring in the longer slot in the coupling hub and turn the hub one full turn, then push the assembly together and install it onto the magneto.

Distributor Gear Assembly

There are three types of distributor bearings used in FM-X magnetos. An oilite sleeve bearing or a needle bearing may be used in types FM-X4, FM-XE, FM-XF2 FM-XYE and FM-XZE magnetos. To remove the distri-

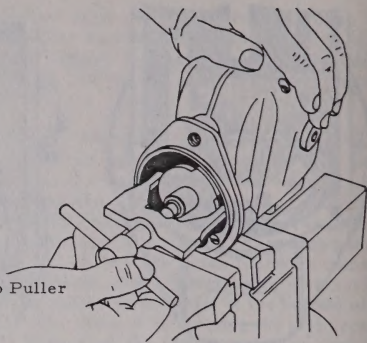


Fig. 8a. Coupling Hub Puller

butor rotor gear, remove the distributor shaft snap ring and slide the shaft and gear from the bearing support, Fig. 9.

Ball bearings are used in the FM-E, FM-XR, and FM-XOR magnetos. To remove the distributor bearing from these magnetos, take out the distributor shaft snap ring. Place a piece of soft lead on the bench, turn the bearing support over so the distributor shaft points downward, grip the bottom of the bearing support with both hands, and strike the end of the distributor shaft on the lead a few times to jar the shaft loose from the bearing.

Distributor sleeve bearings may be pressed out of their respective bearing supports by means of the hand screw press 370TD, and the distributor bearing tool TD2252A. To remove the distributor ball bearing, take off the distributor bearing snap ring and press the bearing out of its support.

Magnetic Rotor Types FM-X, FM-XV

There are three types of magnetic rotors used in the series X magnetos: a two-pole rotor with block magnets; a two-pole rotor with bar magnets perpendicular to the rotor axis; a four-pole rotor with a cylindrical magnet, Fig. 10.

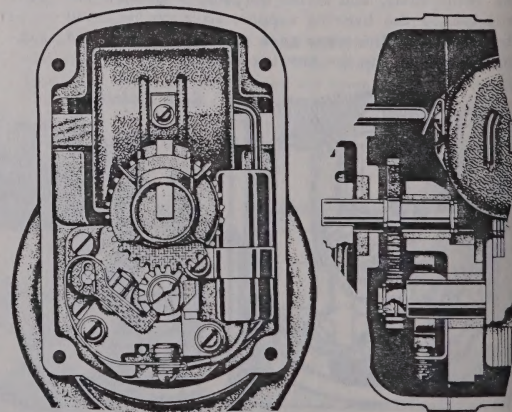


Fig. 9. Bearing Support with Distributor Gear Assembly and Distributor Rotor

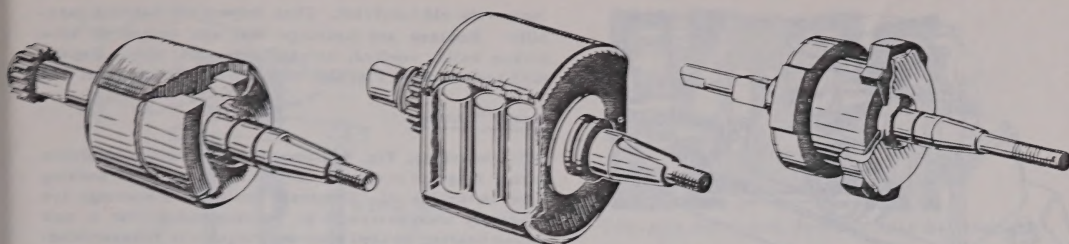


Fig. 10. Two-pole Rotor with Block Magnets.

Two-pole Rotor with Bar Magnets Placed Perpendicular to Rotor Axis

Four-pole Rotor with Cylindrical Magnet

With the impulse coupling and bearing support removed, take out the oil slinger baffle disc, found only on flange mounting magnetos with integral flange. Then remove the rotor drive end seal outer washer by striking it with a punch on the shaft edge. This dishes the washer and permits easy removal. On more recent models, the rotor drive end seal outer washer is made with one edge cut flat making it easy to insert the point of a screwdriver and loosen the washer. Discard the washer after it has been removed from the magneto.

Lift out the rotor drive end seal and the rotor drive end seal inner washer. This washer is a loose fit but may be difficult to remove due to the adhesion of bearing grease. Finally, remove the magneto rotor shaft snap ring which is found only on the types FM-X, FM-XD, FM-XDE, FM-XE, FM-XF, FM-XFE and FM-XZE magnetos.

Press the rotor out of the housing. Place the assembly in the adjustable press with the cam end of the rotor shaft carefully centered in the large hole of the base plate. Then place the brass protective cap over the threaded end of the rotor shaft and apply an even pressure by slowly turning the drive screw. As soon as the rotor is pressed out of the drive end bearing it may be removed from the magneto housing.

In magnetos that have the rotor drive end bearing retaining washer, this washer must be removed before the bearing can be pressed out of the housing.

Remagnetizing Magnetic Rotor

Due to the exceptional stability of the Alnico magnets used in Fairbanks Morse magnetos, it is recommended that the rotor be remagnetized only when it has been definitely determined that the ignition spark is below the required minimum value. The remagnetizing process involves the use of suitable equipment and should be undertaken in accordance with the following instructions.

Magnetization

The length of the magnetizing time depends on the type and strength of the charger. It is recommended that the rotors be given a minimum charge of 30 seconds, broken into two periods, or "shots." Arrangements should be made to place the rotor in the magneto housing as soon as it is taken from the magnetizer.

Two-pole Rotors

Determine the polarity of the rotor and the magnetizer, Fig. 11. Place the magnetic pole of the rotor, which attracts the N pole of a compass, in contact with the magnetic pole of the charger which attracts the S pole of the compass. By holding the rotor in the vicinity of a charger while it is in operation, the attraction of unlike poles is easily discernible.

All rotors except those for type FM-XV magnetos are of the two-pole design and should be placed in the charging blocks as described above. The large radii of the charging blocks should be used for rotors from types FM-E, FM-XR and FM-XOR magnetos, and the small radii should be used for rotors from type FM-X units.

Four-pole Rotors

Four-pole rotors, Fig. 12, used in type FM-XV magnetos, must be remagnetized with special care. These rotors have large cylindrical magnets with the axis of the poles parallel to the shaft. The magnetizing blocks must be placed on the charger with maximum surface contact. Insert the rotor in the drilled holes of the magnetizing block with the keyway up.

Drive End Ball Bearing

Release the bearing snap ring with snap ring pliers, and place the magneto in the hand screw press 370TD. Put a brass protective cap over the center of the bearing, Fig. 13. As the screw is turned down, center the assembly in the press. Apply pressure evenly to the inner bearing race until the inner bearing race and ball re-

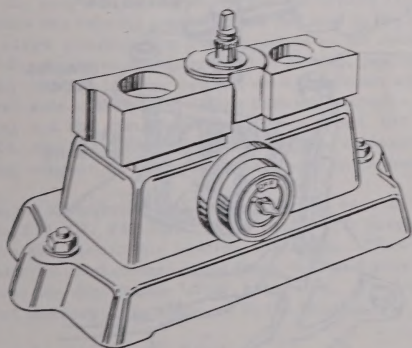


Fig. 11. Magnetizing Standard Two-pole Rotor with Bar Magnets. To magnetize standard two-pole rotor with block magnets, use same setup but reverse charging blocks.

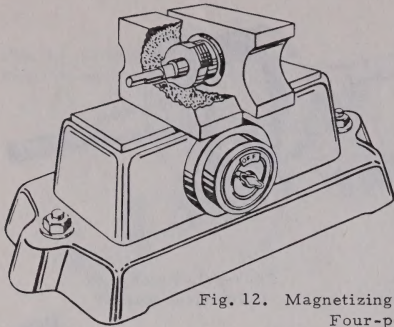


Fig. 12. Magnetizing Standard
Four-pole Rotor

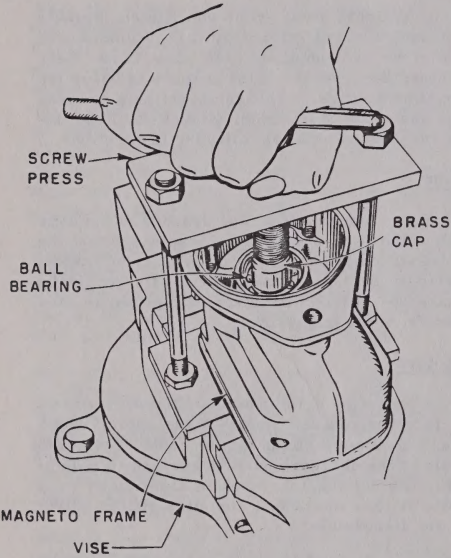


Fig. 13. Pressing Ball Bearing Out of Housing

taining ring are pressed out. The outer bearing race will remain in the housing and may be pressed out if desired. If the bearing is of the non-separable type, the outer race driver must be used with 370TD hand press to press the entire bearing out of the housing

Ball and Needle Bearings

Clean the grease out of the ball bearing, Fig. 14, and the needle bearings, Fig. 15, if used, by soaking them in a petroleum solvent, turning the bearing cage slowly to

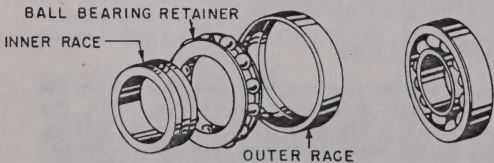


Fig. 14. Separable and Non-separable Ball Bearings

loosen the old lubricant. Then inspect the bearing carefully. Replace any bearings that are frozen or have broken balls, needles, or excessive axial play. Repack each bearing with FMCO11 magneto bearing grease.

Sleeve Bearings

Oilite bearings, Fig. 16, found in serviceable condition during magneto overhaul may be replaced after soaking them in turbine oil. However, since these bearings are relatively inexpensive it is recommended that a new sleeve bearing be used when the magneto is reassembled.

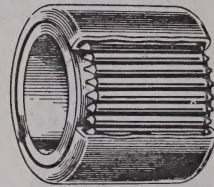


Fig. 15. Needle Bearing

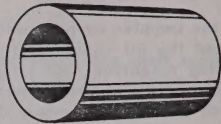


Fig. 16. Sleeve Bearing

Miscellaneous Parts

All other parts should be cleaned with a small, stiff brush moistened with a petroleum solvent. Inspect all castings and machined parts for chips, cracks, stripped or mutilated thread or other defects. Inspect all gears for chips, cracks, broken teeth; all bearing surfaces and keyways and all springs for bending, cracking or loss of tension. Replace any defective parts.

REASSEMBLY OF MAGNETO

If during the overhaul of the magneto the housing has been cleaned with any type solvent solution, be sure to remove any traces of the solution with water and finally remove any remaining water and foreign material with a

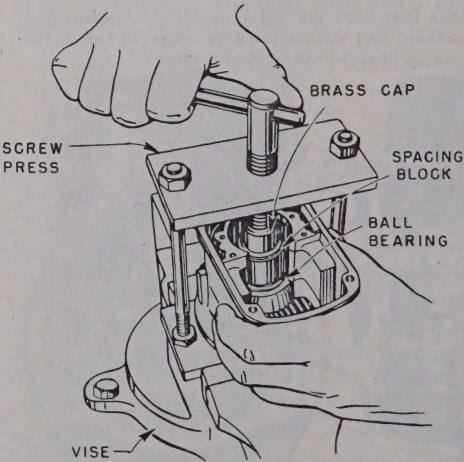


Fig. 17. Pressing Rotor Drive End
Bearing into Housing

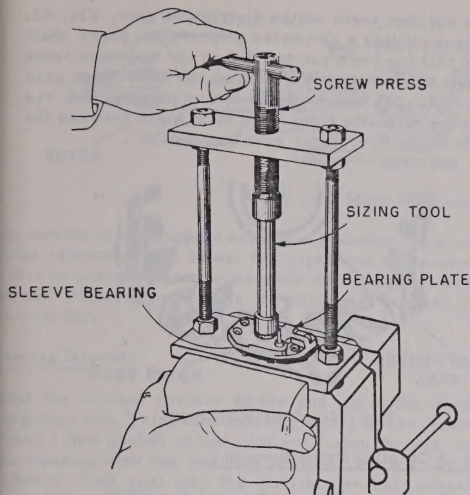


Fig. 18. Pressing Sleeve Bearing into Bearing Support

Petroleum solvent. Then dry the housing thoroughly before reassembling the magneto.

Replacement of Drive End Bearing Types FM-X1, FM-X2, FM-X4, FM-XE4

The drive end ball bearing used in types FM-X1, FM-X2, FM-X4, and FM-XE4 magnetos, when cleaned, inspected, and repacked with FMCO11 magneto bearing grease, may be replaced in the housing, Fig. 17. Center the bearing by hand, in the housing, and place the housing in the screw press. Place the bearing above the support block carefully centering it with the bearing. Then turn down the drive screw of the press, placing the brass cap between the drive screw and the support block. Be sure the assembly is perpendicular in the press before forcing the bearing into the housing. Replace the magnetic rotor drive end bearing snap ring.

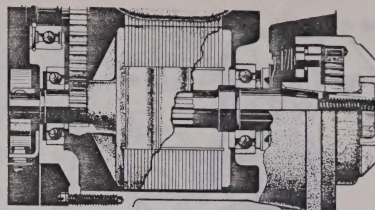
Replacement of Sleeve Bearings

Push the new sleeve bearing on the end of tool TD2252A and place the bearing support plate and tool in the 370TD hand screw press in the same position as for removal, Fig. 18. Apply an even, gradual pressure, pushing the bearing into the bearing support until it is flush with the breaker side of the plate. When both the magnetic rotor bearing and the distributor bearing in types FM-XF2, FM-X4, and FM-XE4 magnetos have been replaced, the bearing support is ready to be replaced in the housing.

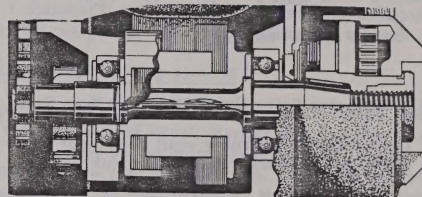
Press the distributor ball bearing into its recess, types FM-E, FM-XR, FM-XOR, using the 370TD press, and replace the distributor bearing snap ring. Then press the distributor shaft into place using the hand press, and replace the distributor shaft snap ring. The bearing support is ready to be replaced in the housing.

Reassembly of Magnetic Rotor Types FM-XV, FM-XOR, FM-E

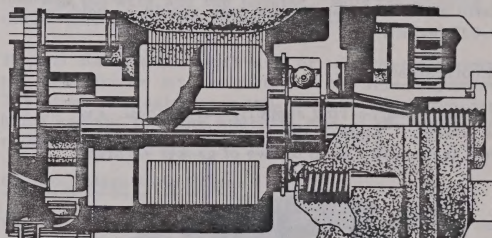
Place a new magnetic rotor bearing oil seal in the drive end recess of the rotor, and a new magnetic rotor seal



Two-pole Rotor with Perpendicular Bar Magnets



Four-pole Rotor with Cylindrical Magnet



Two-pole Rotor with Block Magnets

Fig. 19. Three Types Magnetic Rotors Assembled in Housing

in the cam end recess of the rotor for type FM-XV magnetos, Fig. 19. Slide the bearing thrust washer next to the magnetic rotor gear on rotors for types FM-XR, FM-XOR, and FM-E magnetos. Place the assembly in the hand screw press and with the rotor accurately aligned with the bearing race, press the inner bearing race onto the rotor using the inner race driver OMT82 as an auxiliary tool. Press the bearing race for the drive end bearing of types FM-XR, FM-XOR, and FM-E magnetos onto the rotor until it reaches the shoulder of the lamination assembly. Press the races for the other bearings onto the rotor as far as the washers and cork seals will permit. Place the ball retainer on the inner bearing races and replace the rotor and bearing into the housing.

Replacement of Magnetic Rotor into Housing Types FM-X1, FM-X2, FM-X4

The magnetic rotor types FM-X1, FM-X2, FM-XF2 and FM-XE4 magnetos must be pressed into the housing, Fig. 20, using the 370TD screw press. Place housing in the press with the drive end bearing accurately centered over the large hole in base plate. Then, with brass cap over cam end of the rotor, press the rotor into the bearing until the shoulder of the lamination assembly touches the inner race of drive end bearing. Replace the rotor drive end shaft snap ring in its groove on

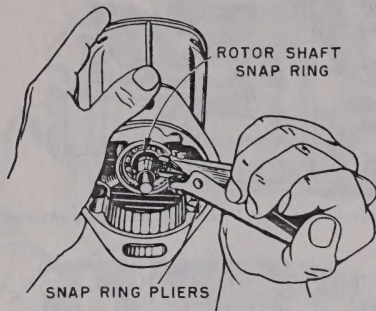


Fig. 20. Replacing Rotor Drive End Shaft Snap Ring

the rotor shaft; replace the rotor shaft seal inner washer, rotor shaft seal and rotor shaft seal outer washer.

When replacing the magnetic rotor on the FM-O, FM-XO, FM-XOR, FM-XY, FM-XV and all magnetos with three piece ball bearings, end end play tolerance of the magnetic rotor between its bearings should be held below 0.007 inches.

Coil Replacement

Before replacing bearing support, set the coil, Fig. 21, in the housing. Tighten the two coil bridge setscrews and seal them with a drop or two of gasket varnish.

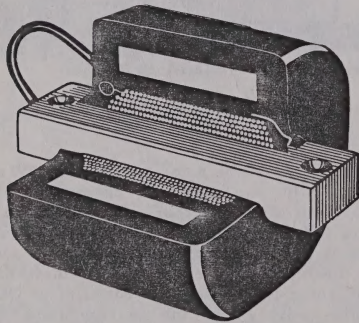


Fig. 21. Cutaway of Molded Coil

Replacement of Bearing Support Assembly and Internal Timing

Replace the distributor shaft and gear assembly in the bearing support of types FM-XF2, FM-X4, and FM-XE4 magnetos and secure it in place with the distributor shaft snap ring. Fasten the bearing support assembly in the housing. Replace the magnetic rotor gear pin and magnetic rotor gear. The former can be tapped into position by placing a hollow cylindrical tool, such as the OMT82, over the cam end of the rotor with the gear partially in place, and striking the cylindrical tool a few light taps. On later model magnetos the new type magnetic rotor can be easily assembled on the cam end of the magnetic rotor without special tools. A snap ring holds this gear onto the shaft. Care must be exercised in meshing the marked teeth of the magnetic rotor gear

with the marked teeth of the distributor gear, Fig. 22. when reassembling a clockwise magneto the gears must mesh so that the tooth painted red on the magnetic rotor will mesh between the two teeth on the distributor gear marked "C". On a counterclockwise magneto the red tooth on the magnetic rotor gear must mesh between the two teeth on the distributor gear marked "A".

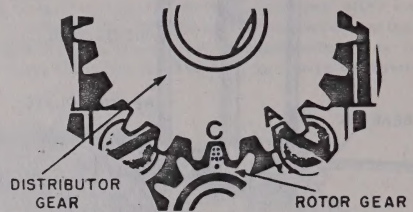


Fig. 22. Gear Markings

Rotation of Coupling Drive Springs

The coupling drive spring can be used for either rotation by simply turning it over. Care must be taken to place the spring correctly in the shell, since incorrect assembly will damage the inside anchor end. Fig. 23. illustrates the correct location of drive springs in series U coupling shells. Catch the inner end of the drive spring in the longer slot of the coupling hub and complete the assembly by winding the drive spring one full turn. Push the assembly together and key the coupling onto the rotor shaft. Replace the impulse coupling nut lockwasher, screw the impulse coupling nut into place, and turn up the lugs on the impulse coupling nut lockwasher, or replace the coupling nut lockwire, if used.

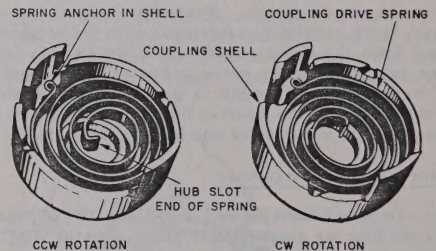


Fig. 23. Position of Drive Spring in Coupling Shell

Assembly of Breaker Mechanism

Remount the condenser on the bearing support. On type FM-XV magnetos the cam wick and holder assembly is mounted on the condenser mounting screw, along with the condenser. On all other magnetos except those with feed-thru condensers the cam wick and holder assembly is supported by the No. 8 contact support locking screw. Remount the breaker arm support bracket by means of the two support bracket locking screws, lockwashers, and flat washers. Slide the arm onto the fulcrum pin and replace the fulcrum pin snap ring.

Place the lead wire terminal from the coil, the terminal from the condenser, the terminal from the ground switch, and the end of the breaker arm spring onto the breaker arm terminal screw, and fasten this screw in

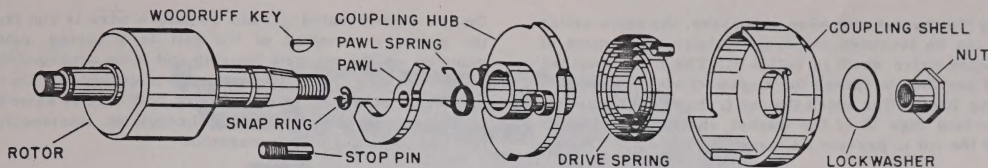


Fig. 24. Magnetic Rotor and Disassembled Impulse Coupling

the bottom of the support bracket. Measure the breaker point clearance and adjust the clearance if necessary. Refer to paragraph under Breaker Arm, Support Bracket and Points, for details on adjusting breaker point clearances.

Sealing Magneto

Coat the contact surface of the end cap of the standard magnetos with Fairbanks Morse FMCO2 Gasket Varnish. Place a new gasket in the joint and fasten the end cap on the housing with the end cap screws. Push a new distributor shaft seal into the distributor shaft recess in the end cap of types FM-X4, FM-XF2, FM-XR, FM-XOR and FM-XV4B7 magnetos. Replace the distributor rotor on the end of the distributor shaft, pushing it into place as far as it will go. Then replace the end cap cover using a new gasket.

TIMING MAGNETO TO ENGINE

Accurate timing of the magneto to the engine produces an ignition spark in each cylinder at the exact instant the fuel mixture should be ignited for best engine performance. This instant, which is determined by the engine manufacturer, is designated as a given number of degrees of angular travel of the crankshaft before the piston reaches inner dead center on the compression stroke. When starting the engine, it is advisable to retard the ignition spark until it occurs late enough in the cycle to avoid backfiring. Impulse couplings when used with magnetos automatically provide this spark retarding feature while the engine is being started.

The importance of correctly timing the magneto to the engine cannot be overemphasized, and the steps described below should be followed carefully. Either the advanced spark position method or the impulse coupling trip method may be used. Whichever method is used, the breaker points must first be accurately adjusted to secure proper timing of the ignition spark.

Advance Spark Position Method

Magneto: Set the magneto for advance spark position in the No. 1 cylinder. This is done by turning the rotor from the coupling end in the direction opposite to normal rotation until the distributor contact lines up exactly with the timing boss. With certain exceptions the No. 1 outlet on four-cylinder magnetos is the upper left of the four terminals. On type FM-XOR six-cylinder magnetos the No. 1 cylinder outlet is usually diagonally upward, 30° to the left of vertical. When the magneto is timed for advance spark in the No. 1 cylinder, it should be held exactly in the position until coupled to the engine.

Engine: Engine builders usually indicate by marks on the flywheel and flywheel housing, the position of the engine for advance spark timing. Refer to the engine manufacturer's instruction book for details concerning timing

marks on your particular engine. Then rotate the crankshaft until the timing marks coincide, indicating that the No. 1 cylinder is in advance-spark firing position. Be sure that the piston is on its compression stroke.

Impulse Coupling Trip Method

Magneto: Remove the end cap cover on the end cap. Set the magneto for spark discharge to the No. 1 terminal. This may be accomplished by use of a stiff, short length of wire placed in the No. 1 socket and bent to within 1/8 in. of the magneto frame. Then turn the magnetic rotor from the impulse coupling end in its normal direction of rotation until a spark is observed between the wire and the housing. Hold the coupling in the position in which the trip occurred.

Engine: Remove the spark plug, or otherwise determine top dead center for the piston in the No. 1 cylinder. Then turn the engine over until this position is reached, being certain that the piston is just at the end of its compression stroke.

Coupling Magneto to Engine

Without disturbing the setting of either magneto or engine as determined by the methods above, couple the engine in the following manner

Flange Mounting Magnetos: Engage the drive lugs of the impulse coupling with the driving slots of the engine drive member. A slight movement of the engine flywheel may be necessary to secure accurate alignment. Tighten capscrews and nuts securely.

Base Mounting Magnetos: If no change has been made in the position of the member, it is necessary only to engage the drive lugs of the impulse coupling with the drive slots of the float disc. Be sure that the shaft assembly is properly aligned before securing the base mounting screws.

Adjustable Drive Members

Most engines using base mounting magnetos are equipped with adjustable drive members, Fig. 25. Ordinarily the position of the drive member is not altered when re-

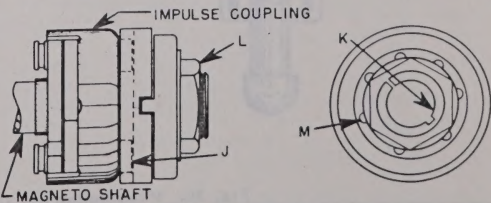


Fig. 25. Adjustable Drive Member

moving the magneto but when necessary, the drive collar nut L can be loosened to permit relative movement of the engine drive shaft in collar K. The drive member slots J can then be turned for alignment with the impulse coupling lugs, after which the nut L should be tightened. The locking lugs M of the washer should be turned up around the nut to prevent its coming loose.

Primary Ground Switches

Engines may be stopped by shutting off the fuel supply or grounding out the magneto ignition circuit. Shutting off the fuel supply has the disadvantage of not stopping the engine quickly, while grounding the ignition circuit stops the engine at once.

Battery ignition systems must be opened to stop the engine while in magneto ignition systems the ignition circuit must be grounded to stop the engine.

Primary ground switches must be located in the primary circuit of either type magneto, Fig. 26. The action is instantaneous and fuel is left in the fuel system for immediate starting.

There are many types or styles of ground switches, but in general they may be divided into two groups, those located on the unit and those located away from the unit.

On the self-mounted ground switch, a wire is run from the primary terminal of the coil to a spring switch mounted on the magneto housing and is so arranged that when operated the primary circuit is grounded. On the mounted switch the same primary coil wire is extended to the control panel, usually through an intermediate terminal mounted on the magneto.

When stopping the engine by grounding out the primary circuit, the switch must be kept closed until the engine stops.

Radio Shielded Magnetos

The high voltage spark discharge, which provides ignition for the engine, often causes interference in radio reception. Frequently it is necessary or desirable to eliminate this interference, Fig. 27. In principle, the radio shielding of a magneto requires the replacement of the plastic end cap by an all metal end cap with an insulated plastic distributor block mounted inside. Special outlets are provided for the metal encased high tension cables, and the spark plugs are metal covered. All this exterior metal housing is interconnected and grounded to function as a shield and absorb the interference causing waves. On certain magnetos for military applications the primary ground terminal is located on the end of the feed-thru condenser or on the end of the primary circuit connector.

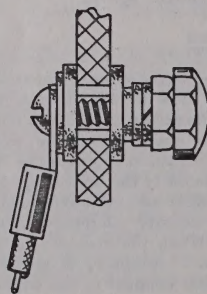
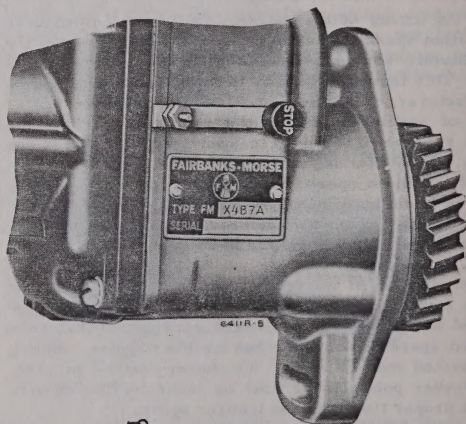
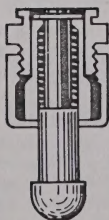
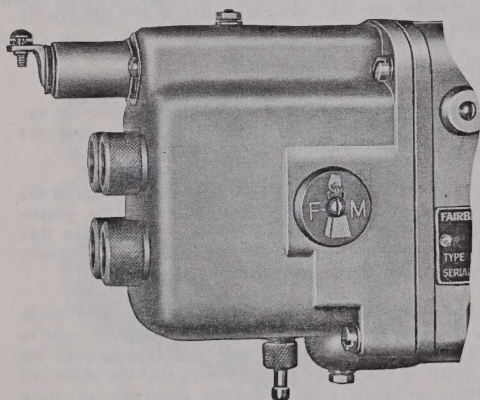


Fig. 26. Push-button and Lever Type Type Ground Switches

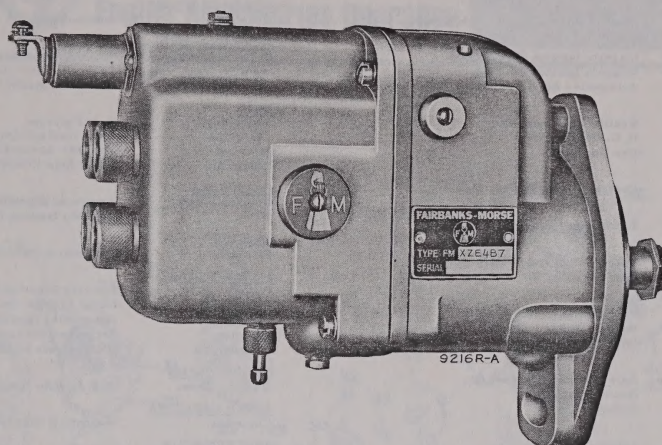


Fig. 27. Complete Radio Shielded Magneto

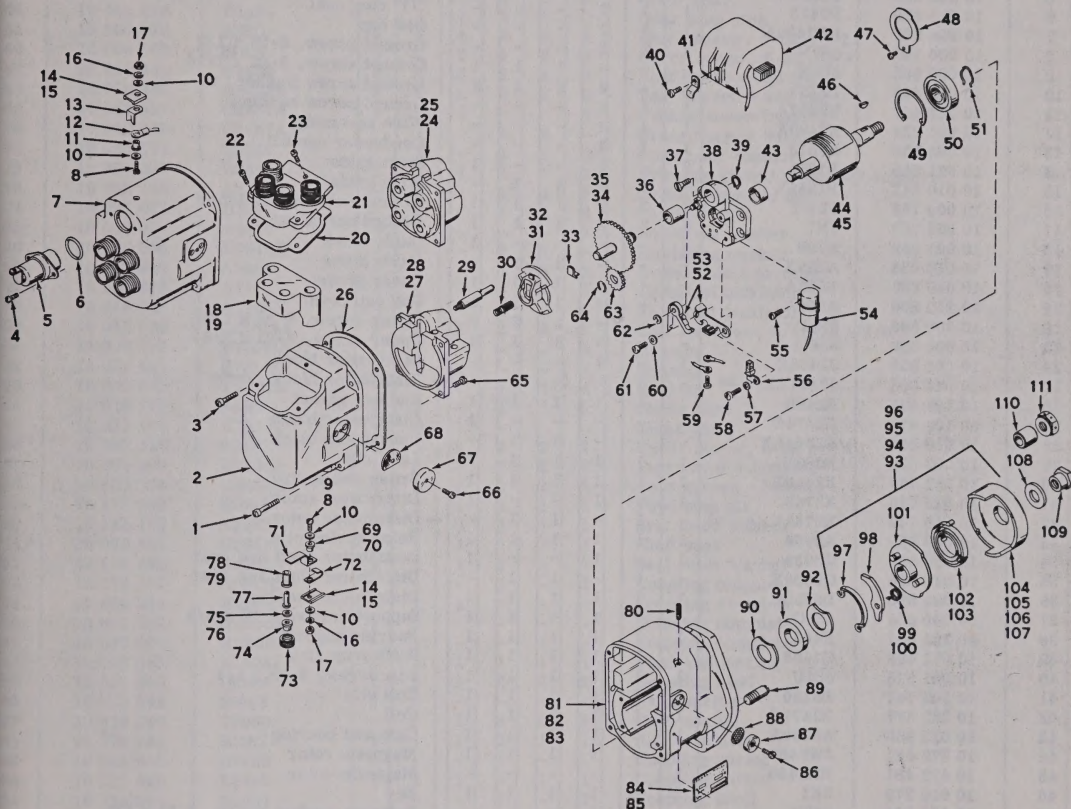
Colt Industries



Fairbanks Morse Engine Accessories Operation

Beloit, Wisconsin

PARTS LIST
TYPE FMXE4B MAGNETOS
 FMXE4B16V, 16W, 16Y, 17, 17A, 17B
 10 004 476, 10 004 484, 10 004 499
 10 006 465, 10 006 490, 10 010 430



DATA		FM XE4B 16V	FM XE4B 16W	FM XE4B 16Y	FM XE4B 17	FM XE4B 17A	FM XE4B 17B	MAGNETO PART NUMBERS	
Rotation		CW	CW	CW	CW	CW	CW		
Impulse Coupling		UB	UB	UB	UB	UB	UB		
Lag Angle		25°	20°	20°	45°	35°	35°		
Engine Manufacturer and Specification Number	Continental Motor Corp.	X	-	-	-	-	-	FMXE4B16V	10 004 476
	Continental Motor Corp. - F162M448	-	X	-	-	-	-	FMXE4B16W	10 004 484
	Continental Motor Corp. - Y69M422	-	-	X	-	-	-	FMXE4B16Y	10 004 499
	Buda Div. - Allis Chalmers Mfg. Co.	-	-	-	X	-	-	FMXE4B17	10 006 465
	Buda Div. - Allis Chalmers Mfg. Co.	-	-	-	-	X	-	FMXE4B17A	10 006 490
	Buda Div. - Allis Chalmers Mfg. Co.	-	-	-	-	-	X	FMXE4B17B	10 010 430
Ref. No.	Part Number	Part Number	Number Used					Description	
1	10 001 730	10S18D	2	2	2	2	2	End cap screw, 10-24 x 1-1/8	
2	10 001 038	HY2430	-	-	-	1	1	End cap	
3	10 000 894	10S12D	2	2	2	2	2	End cap screw, 10-24 x 3/4	
4	10 000 882	6S6D	2	2	2	-	-	Condenser screw, 6-32 x 3/8	

Parts List X4-66
 MAY, 1966

Ref. No.	Part Number	Part Number	Number Used							Description
5	10 003 596	MX2433	1	1	1	-	-	-	-	Feed-thru condenser .28-.35 μ fd
6	10 011 679	P2473	1	1	1	-	-	-	-	"O" ring seal
7	10 004 252	RX2430A	1	1	1	-	-	-	-	End cap
8	10 000 706	6S8N	2	2	2	-	-	-	-	Ground screw, 6-32 x 1/2
9	10 000 663	6S7N	-	-	-	1	1	1	1	Ground screw, 6-32 x 7/16
10	10 042 458	D2458	4	4	4	2	2	2	2	Ground screw washer, #6
11	10 122 457	H2457A	1	1	1	-	-	-	-	Ground screw bushing
12	10 004 238	K2499A	1	1	1	-	-	-	-	Wire assembly
13	10 003 058	K2513	1	1	1	-	-	-	-	Condenser contact
14	10 021 355	B1355	2	-	2	-	-	-	1	Strip guide
15	10 010 041	B1355X	-	2	-	1	1	-	-	Strip guide
16	10 000 768	6LW1	2	2	2	1	1	1	1	Ground screw lockwasher
17	10 000 350	6N1	2	2	2	1	1	1	1	Ground screw nut
18	10 001 952	A799	-	-	-	-	-	-	1	Guide block
19	10 010 038	A799X	-	-	-	1	1	-	-	Guide block
20	10 080 682	B682A	-	-	-	1	1	1	1	Cover gasket
21	10 310 800	A800A	-	-	-	1	1	1	1	End cap cover
22	10 000 890	8S8D	-	-	-	2	2	2	2	Cover screw, 8-32 x 1/2
23	10 000 889	8S6D	-	-	-	1	1	1	1	Cover screw, 8-32 x 3/8
24	10 003 958	J2474E	1	-	1	-	-	-	-	Distributor block
25	10 014 068	J2474EX	-	1	-	-	-	-	-	Distributor block
26	10 102 498	K2498	1	1	1	1	1	1	1	End cap gasket
27	10 102 474	B2474E	-	-	-	-	-	-	1	Distributor shaft and gear
28	10 010 044	B2474EX	-	-	-	1	1	-	-	Distributor block
29	10 003 036	B983B	1	1	1	1	1	1	1	Lead rod
30	10 052 460	E2460B	1	1	1	1	1	1	1	Brush and spring
31	10 010 748	X2765	1	-	1	-	-	-	1	Distributor rotor
32	10 010 749	X2765X	-	1	-	1	1	-	-	Distributor rotor
33	10 000 659	A2766	1	1	1	1	1	1	1	Rotor spring clip
34	10 155 939	Q5939	1	-	1	-	-	-	1	Distributor shaft and gear
35	10 010 084	Q5939X	-	1	-	1	1	-	-	Distributor shaft and gear
36	10 095 950	D5950C	1	1	1	1	1	1	1	Distributor bearing
37	10 000 668	8S6G	4	4	4	4	4	4	4	Support screw, 8-32 x 3/8
38	10 224 631	X4631	1	1	1	1	1	1	1	Bearing support
39	10 071 498	G1498	1	1	1	1	1	1	1	Shaft snap ring
40	10 001 818	6S4U	1	1	1	1	1	1	1	Clip screw, 6-32 x 1/4
41	10 001 742	B6120	1	1	1	1	1	1	1	Coil clip
42	10 362 477	R2477C	1	1	1	1	1	1	1	Coil
43	10 025 950	A5950A	1	1	1	1	1	1	1	Cam end bearing
44	10 372 481	JW2480	-	1	1	1	1	1	1	Magnetic rotor
45	10 472 481	RN2480	1	-	-	-	-	-	-	Magnetic rotor
46	10 000 379	3K1	1	1	1	1	1	1	1	Key
47	10 001 930	8S6U	-	-	1	-	-	-	-	Retainer washer screw, 8-32 x 1/2
48	10 003 944	A2492D	-	-	1	-	-	-	-	Bearing retainer washer
49	10 101 498	B1498B	1	1	-	1	1	1	1	Bearing snap ring
50	10 105 949	C5949	1	1	1	1	1	1	1	Drive end bearing
51	10 131 498	B1498D	1	1	1	1	1	1	1	Shaft snap ring
52	10 412 437	A2437A	1	-	1	-	-	-	1	Point set
53	10 010 570	A2437AX	-	1	-	1	1	-	-	Point set
54	10 010 215	SXY2433	-	-	-	1	1	1	1	Condenser .28-.36 μ fd
55	10 013 062	8S5NA	-	-	-	1	1	1	1	Condenser screw, 8-32 x 5/16
56	10 072 788	G2788	1	1	1	1	1	1	1	Cam wick
57	10 025 969	B5969	1	1	1	1	1	1	1	Support screw washer, #8
58	10 001 930	8S6U	1	1	1	1	1	1	1	Support screw, 8-32 x 3/8
59	10 011 694	6S6Z	1	1	1	1	1	1	1	Terminal screw, 6-32 x 3/8
60	10 042 458	D2458	1	1	1	1	1	1	1	Support screw washer, #6
61	10 004 028	6S6U	1	1	1	1	1	1	1	Support screw, 6-32 x 3/8
62	10 011 884	C1498G	1	1	1	1	1	1	1	Fulcrum pin snap ring

(Continued on Page 3)

Ref. No.	Part Number	Part Number	Number Used							Description
(Continued from Page 2)										
63	10 010 360	Q5952	1	1	1	1	1	1	1	Rotor gear
64	10 041 498	D1498	1	1	1	1	1	1	1	Gear snap ring
65	10 000 890	8S8D	4	4	4	4	4	4	4	Block screw, 8-32 x 1/2
66	10 000 662	6S6N	2	2	2	2	2	2	2	Cover screw, 6-32 x 3/8
67	10 011 232	A1232	2	2	2	2	2	2	2	Vent cover - end cap
68	10 036 032	A6032A	2	2	2	2	2	2	2	Vent screen - end cap
69	10 112 457	G2457A	1	-	1	-	-	-	1	Ground screw bushing
70	10 010 042	G2457AX	-	1	-	1	1	-	-	Ground screw bushing
71	10 082 514	H2514	-	-	-	1	1	1	1	Condenser contact
72	10 004 399	Z2514	1	1	1	1	1	1	1	Primary ground to contact support
73	10 022 735	A2735A	-	-	-	1	1	1	1	Ground terminal nut
74	10 021 077	B1077	-	-	-	1	1	1	1	Cable ferrule
75	10 016 018	A6018	-	-	-	-	-	-	1	Insulating washer
76	10 010 039	A6018X	-	-	-	1	1	-	-	Insulating washer
77	10 013 969	A3969	-	-	-	1	1	1	1	Ground cable terminal
78	10 011 166	A1166	-	-	-	-	-	-	1	Terminal insulator
79	10 010 043	A1166X	-	-	-	1	1	-	-	Terminal insulator
80	10 010 938	31SS14A	2	2	2	2	2	2	2	Coil setscrew, 5/16-20 x 7/8
81	10 003 912	PW2425	1	-	-	-	-	-	-	Housing
82	10 003 541	QW2425	-	1	1	-	-	-	-	Housing
83	10 003 539	TZ2425	-	-	-	1	1	1	1	Housing
84	10 010 195	A195	1	1	-	1	1	1	1	Name plate
85	10 011 783	K195	-	-	1	-	-	-	-	Name plate
86	10 001 818	6S4U	2	2	2	2	2	2	2	Cover screw, 6-32 x 1/4
87	10 004 099	B6030A	2	2	2	2	2	2	2	Vent cover - housing
88	10 003 564	C6032B	2	2	2	2	2	2	2	Vent screen - housing
89	10 172 568	S2568	1	1	1	1	1	1	1	Pawl stop pin
90	10 112 492	A2492C	1	1	1	1	1	1	1	Seal inner washer
91	10 073 861	G3861	1	1	1	1	1	1	1	Shaft seal
92	10 012 492	A2492A	1	1	1	1	1	1	1	Seal outer washer
93	10 172 562	S2563C	-	-	-	1	-	-	1	Coupling complete
94	15 652 564	BZ2563C	-	1	1	-	-	-	-	Coupling complete
95	15 612 564	HZ2563C	1	-	-	-	-	-	-	Coupling complete
96	15 572 564	RZ2563C	-	-	-	-	1	-	-	Coupling complete
97	10 013 586	A1498J	1	1	1	1	1	1	1	Pawl lock spring
98	10 001 360	Q2566	2	2	2	2	2	2	2	Coupling pawl
99	10 013 242	S5963	2	-	-	-	-	-	-	Pawl spring
100	10 013 543	T5963	-	2	2	2	2	2	2	Pawl spring
101	10 172 563	S2563	1	1	1	1	1	1	1	Hub assembly
102	10 042 565	D2565	-	-	-	1	-	-	-	Coupling spring
103	10 052 565	E2565	1	1	1	-	1	1	1	Coupling spring
104	10 135 957	N5957	-	-	-	1	-	-	1	Coupling shell
105	10 235 957	Y5957	-	-	-	-	1	-	-	Coupling shell
106	10 295 957	EX5957	-	1	1	-	-	-	-	Coupling shell
107	15 515 957	DY5957	1	-	-	-	-	-	-	Coupling shell
108	10 011 781	B5931B	-	1	1	1	1	1	1	Coupling nut lockwasher
109	10 011 740	U2570	-	1	1	1	1	1	1	Coupling nut
110	10 072 572	G2572	1	-	-	-	-	-	-	Gear bushing
111	10 162 570	R2570	1	-	-	-	-	-	-	Coupling nut

Parts with number ending in "X" are fungus treated.



Colt Industries

INSTRUCTIONS
TYPE FM-E, X, Z
MAGNETOS

ENGINE ACCESSORIES OPERATION • BELOIT, WISCONSIN 53511

SERVICE INSTRUCTIONS

TYPE FM-E, FM-X, FM-XD, FM-XDE, **FM-XE**, FM-XF, FM-XFE, FM-XFZ, FM-XO, FM-XOR, FM-XR, FM-XV, FM-XVE, FM-XY, FM-XYE, FM-XZ, FM-XZE, FM-Z AND FM-ZE MAGNETOS

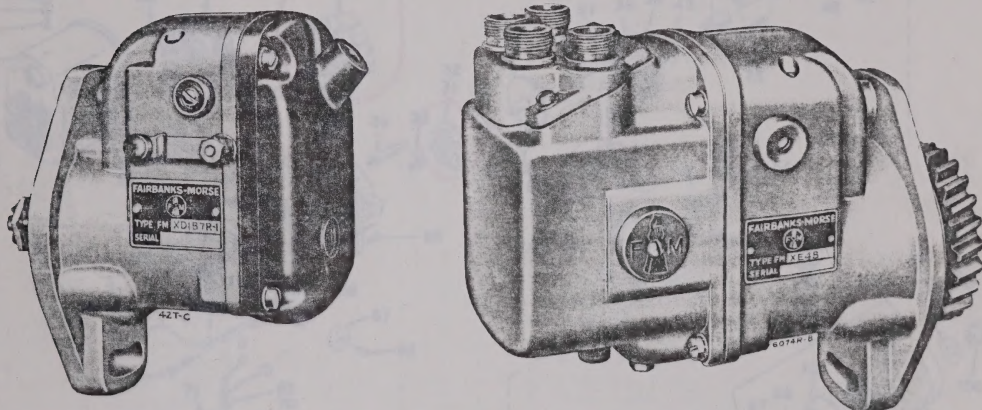


Fig. 1. Standard and Radio Shielded Magnetos

GENERAL DESCRIPTION

Fairbanks Morse Series X magnetos, Fig. 1, are of the rotating magnet design, the basic principle consisting of inducing and continually reversing magnetic flux lines thru an induction coil. This is accomplished by rapidly rotating the permanent magnetic rotor through a stationary field which is the basis of the magnetic circuit.

A one, two, or four-lobe cam actuates a breaker mechanism periodically during each revolution of the rotor. Each time the breaker points are separated by the magnetic rotor cam, an ignition spark is produced. In the one-cylinder magnetos this occurs once per revolution of the rotor. In the two-cylinder magnetos the distributor rotor forms an axial extension of the magnetic rotor and the breaker points are separated twice per revolution of the rotor by a two-lobe cam. Similarly, in the type FM-XV four-pole magnetos, the distributor rotor forms an axial extension of the magnetic rotor. Since the cam of the rotor has four lobes, the breaker points separate four times per revolution producing four ignition sparks. In the standard four-cylinder magnetos, a two-lobe cam is used which produces two ignition sparks per revolution of the magnetic rotor. In all such cases an ignition spark is furnished to each high tension outlet, once for every two revolutions of the magnetic rotor.

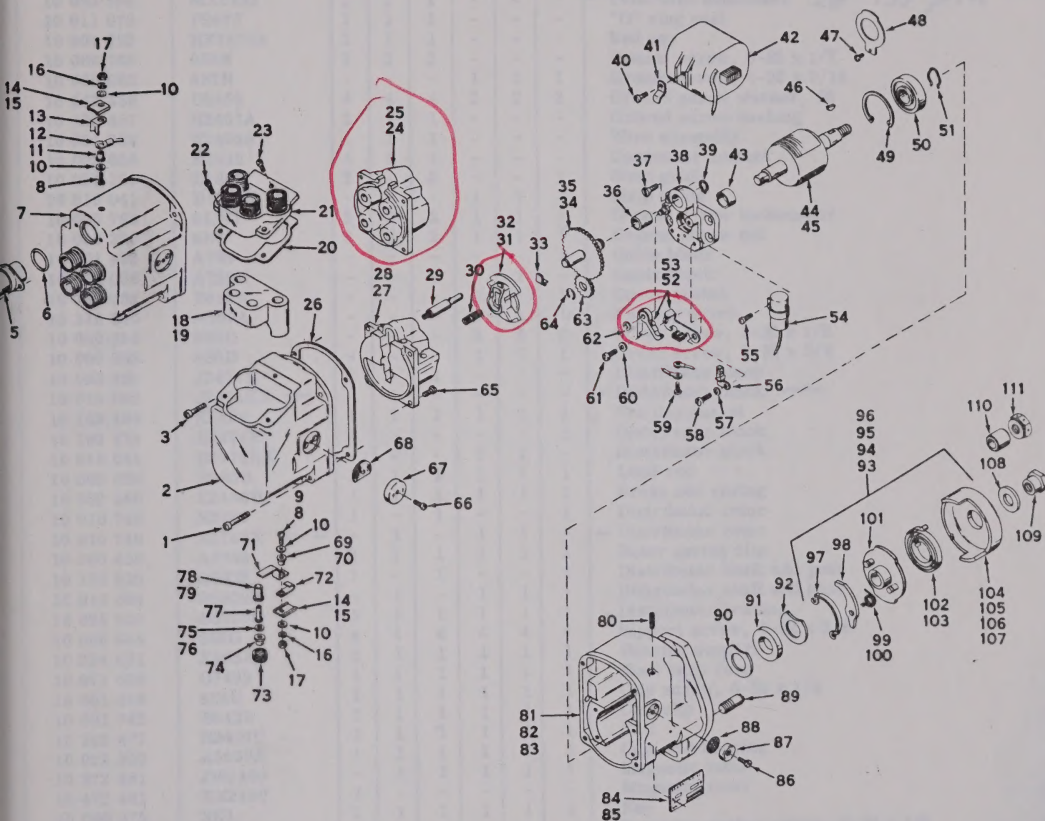
In the FM-XR6 and FMZ6 six-cylinder magnetos, a two-lobe cam is used which produces two ignition sparks per revolution of the magnetic rotor. A gear arrangement is used to connect the magnetic rotor with the distributor rotor which furnishes a spark to each high tension outlet once for every three revolutions of the magnetic rotor.

MAGNETO INSPECTION

The entire magneto should be inspected for worn parts every 1000 hours of operation.

End Cap and End Cap Removal

When the usual inspection and spark tests indicate poor magneto performance, the end cap and end cap cover, Fig. 2, if used, should be removed. Tag the ignition cables to insure their proper replacement in the endcap; then remove each high-tension cable from its socket. In the type FM-E magnetos, the end cap cover must be removed to expose the high tension cable terminals before the lead wires can be removed. When removing the end cap of the types FM-X4, FM-XR, FM-XOR, and the FM-XV magnetos, the end cap cover must be removed and the distributor rotor taken off the end of the rotor shaft before the end cap can be removed.



DATA		FM XE4B 16Y	FM XE4B 16W	FM XE4B 16Y	FM XE4B 17	FM XE4B 17A	FM XE4B 17B	MAGNETO PART NUMBERS	
Rotation		CW	CW	CW	CW	CW	CW		
Impulse Coupling		UB	UB	UB	UB	UB	UB		
Lag Angle		25°	20°	20°	45°	35°	35°		
Engine Manufacturer and Specification Number	Continental Motor Corp.	X	-	-	-	-	-	FMXE4B16V	10 004 476
	Continental Motor Corp. - F162M448	-	X	-	-	-	-	FMXE4B16W	10 004 484
	Continental Motor Corp. - Y69M422	-	-	X	-	-	-	FMXE4B16Y	10 004 499
	Buda Div. - Allis Chalmers Mfg. Co.	-	-	-	X	-	-	FMXE4B17	10 006 465
	Buda Div. - Allis Chalmers Mfg. Co.	-	-	-	-	X	-	FMXE4B17A	10 006 490
	Buda Div. - Allis Chalmers Mfg. Co.	-	-	-	-	-	X	FMXE4B17B	10 010 430
Ref. No.	Part Number	Part Number	Number Used					Description	
1	10 001 730	10S18D	2	2	2	2	2	End cap screw, 10-24 x 1-1/8	
2	10 001 038	HY2430	-	-	-	1	1	End cap	
3	10 000 894	10S12D	2	2	2	2	2	End cap screw, 10-24 x 3/4	
4	10 000 882	6S6D	2	2	2	-	-	Condenser screw, 6-32 x 3/8	

Part Number	Part Number	Number Used						Description
10 003 596	MX2433	1	1	1	-	-	-	Feed-thru condenser .28-.35 μ f
10 011 679	P2473	1	1	1	-	-	-	"O" ring seal
10 004 252	RX2430A	1	1	1	-	-	-	End cap
10 000 706	6S8N	2	2	2	-	-	-	Ground screw, 6-32 x 1/2
10 000 663	6S7N	-	-	-	1	1	1	Ground screw, 6-32 x 7/16
10 042 458	D2458	4	4	4	2	2	2	Ground screw washer, #6
10 122 457	H2457A	1	1	1	-	-	-	Ground screw bushing
10 004 238	K2499A	1	1	1	-	-	-	Wire assembly
10 003 058	K2513	1	1	1	-	-	-	Condenser contact
10 021 355	B1355	2	-	2	-	-	1	Strip guide
10 010 041	B1355X	-	2	-	1	1	-	Strip guide
10 000 768	6LW1	2	2	2	1	1	1	Ground screw lockwasher
10 000 350	6N1	2	2	2	1	1	1	Ground screw nut
10 001 952	A799	-	-	-	-	-	1	Guide block
10 010 038	A799X	-	-	-	1	1	-	Guide block
10 080 682	B682A	-	-	-	1	1	1	Cover gasket
10 310 800	A800A	-	-	-	1	1	1	End cap cover
10 000 890	8S8D	-	-	-	2	2	2	Cover screw, 8-32 x 1/2
10 000 889	8S6D	-	-	-	1	1	1	Cover screw, 8-32 x 3/8
10 003 958	J2474E	1	-	1	-	-	-	Distributor block
10 014 068	J2474EX	-	1	-	-	-	-	Distributor block
10 102 498	K2498	1	1	1	1	1	1	End cap gasket
10 102 474	B2474E	-	-	-	-	-	1	Distributor block
10 010 044	B2474EX	-	-	-	1	1	-	Distributor block
10 003 036	B983B	1	1	1	1	1	1	Lead rod
10 052 460	E2460B	1	1	1	1	1	1	Brush and spring
10 010 748	X2765	1	-	1	-	-	1	Distributor rotor
10 010 749	X2765X	-	1	-	1	1	-	Distributor rotor
10 000 659	A2766	1	1	1	1	1	1	Rotor spring clip
10 155 939	Q5939	1	-	1	-	-	1	Distributor shaft and gear
10 010 084	Q5939X	-	1	-	1	1	-	Distributor shaft and gear
10 095 950	D5950C	1	1	1	1	1	1	Distributor bearing
10 000 668	8S6G	4	4	4	4	4	4	Support screw, 8-32 x 3/8
10 224 631	X4631	1	1	1	1	1	1	Bearing support
10 071 498	G1498	1	1	1	1	1	1	Shaft snap ring
10 001 818	6S4U	1	1	1	1	1	1	Clip screw, 6-32 x 1/4
10 001 742	B6120	1	1	1	1	1	1	Coil clip
10 362 477	R2477C	1	1	1	1	1	1	Coil
10 025 950	A5950A	1	1	1	1	1	1	Cam end bearing
10 372 481	JW2480	-	1	1	1	1	1	Magnetic rotor
10 472 481	RN2480	1	-	-	-	-	-	Magnetic rotor
10 000 379	3K1	1	1	1	1	1	1	Key
10 001 930	8S6U	-	-	1	-	-	-	Retainer washer screw, 8-32 x 1/2
10 003 944	A2492D	-	-	1	-	-	-	Bearing retainer washer
10 101 498	B1498B	1	1	-	1	1	1	Bearing snap ring
10 105 949	C5949	1	1	1	1	1	1	Drive end bearing
10 131 498	B1498D	1	1	1	1	1	1	Shaft snap ring
10 412 437	A2437A	1	-	1	-	-	1	Point set
10 010 570	A2437AX	-	1	-	1	1	-	Point set
10 010 215	XY2433	-	-	-	1	1	1	Condenser .28-.36 μ f
10 013 062	8S5NA	-	-	-	1	1	1	Condenser screw, 8-32 x 5/16
10 072 788	G2788	1	1	1	1	1	1	Cam wick
10 025 909	B5969	1	1	1	1	1	1	Support screw washer, #8
10 001 930	8S6U	1	1	1	1	1	1	Support screw, 8-32 x 3/8
10 011 694	6S6Z	1	1	1	1	1	1	Terminal screw, 6-32 x 3/8
10 042 458	D2458	1	1	1	1	1	1	Support screw washer, #6
10 004 028	6S6U	1	1	1	1	1	1	Support screw, 6-32 x 3/8
10 011 884	C1498G	1	1	1	1	1	1	Fulcrum pin snap ring

(Continued on Page 3)

Automotive Fuel Supply - 422-7492

R 2477 c

Spark Plugs

Electric Auto-Lite

BR8S

Oil Filter

Frame - F3

Air Cleaner

Vortox Co. - **S**60

Type - Oil Bath - Series 859

Fuel Filter

AC - T2

Fuel Pump

AC Model - 1539837

Primer Pump

Dole Valve Company

Model - PR7669

CARBURETER

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2195 E. Edwin Rd.
Decatur, Ill. 62521

Phone (217) 428-4631 Bob Massey

Service Center

Vans Carbureter

1091 Kentucky
Indianapolis, IN. 45221

Phone (317) 634-5651 Steve Kelshaw

Model - TSX - 826-62-S

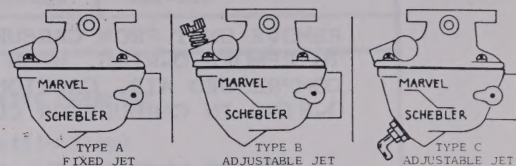
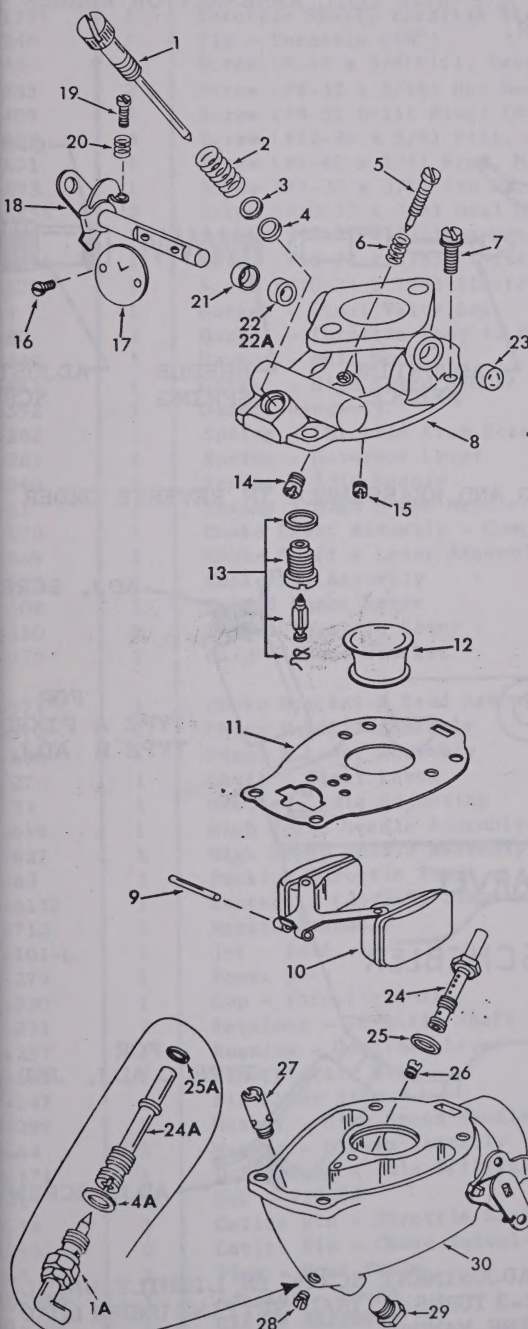
INSTRUCTION SHEET

MARVEL-SCHLEBLER CARBURETOR MODEL-TSX

50-386

GENERAL EXPLODED VIEW

THE GENERAL DESIGN AND PARTS SHOWN WILL VARY TO INDIVIDUAL UNITS COVERED ON THIS INSTRUCTION SHEET



DISASSEMBLY

USE EXPLODED VIEW AS A GUIDE. THE NUMERICAL SEQUENCE MAY GENERALLY BE FOLLOWED TO DISASSEMBLE UNIT FAR ENOUGH TO PERMIT CLEANING AND INSPECTION. NOTE: IDLE JET (14) AND ECONOMIZER JET (15) ARE NOT USED IN ALL CARBURETORS. WHEN REMOVING IDLE JET (14), ECONOMIZER JET (15), OR POWER JET (26) BE SURE TO USE THE PROPER SIZE SCREW DRIVER. JETS CAN EASILY BE BROKEN. BEFORE REMOVING THROTTLE VALVE (17), NOTE ANGLE IDENTIFICATION MARK FACING FLANGE FACE OF CARBURETOR. POWER ADJUSTING NEEDLE SEAT (27) NOT USED IN ALL TYPE B CARBURETORS.

NOMENCLATURE

REF. NO.	REF. NO.
1. NEEDLE-POWER ADJ. (TYPE B)	15. JET-ECONOMIZER
1A. NEEDLE ASSY.-POWER ADJUSTING (TYPE C)	16. SCREW & LOCKWASHER (2) - THROTTLE VALVE
2. SPRING-POWER ADJ. NEEDLE	17. THROTTLE VALVE
3. WASHER-FLAT POWER ADJ. NEEDLE SPRING	18. SHAFT & LEVER ASSY.-THROTTLE
4. GASKET-POWER ADJ. NEEDLE	19. SCREW-THROTTLE STOP.
4A. GASKET-POWER ADJ. NEEDLE ASSY. (TYPE C)	20. SPRING-THROTTLE STOP SCREW
5. NEEDLE-IDLE ADJUSTING	21. RETAINER-THROTTLE SHAFT SEAL
6. SPRING-IDLE ADJ. NEEDLE	22. SEAL (FELT)-THROTTLE SHAFT
7. SCREW & LOCKWASHER (4) - BOWL COVER	22A. SEAL (RUBBER)-THROTTLE SHAFT
8. BOWL COVER	23. CUP-THROTTLE SHAFT
9. PIN-FLOAT LEVER	24. NOZZLE-MAIN (TYPE A-B)
10. FLOAT & LEVER ASSY.	24A. NOZZLE-MAIN (TYPE C)
11. GASKET-BOWL COVER	25. GASKET-MAIN NOZZLE (TYPE A-B)
12. VENTURI	25A. GASKET-MAIN NOZZLE (TYPE C)
13. NEEDLE, SEAT & GASKET ASSY.	26. JET-POWER (TYPE A-B)
14. JET-IDLE	27. SEAT-POWER ADJ. NDL. (TYPE B)
	28. SCREW-PLUG
	29. PLUG-BOWL DRAIN
	30. BOWL ASSY.-FLOAT

CLEANING

CLEANING MUST BE DONE WITH CARBURETOR DISASSEMBLED. SOAK PARTS LONG ENOUGH TO SOFTEN AND REMOVE ALL FOREIGN MATERIAL. USE (1) A CARBURETOR CLEANING SOLVENT, (2) LACQUER THINNER, OR (3) DENATURED ALCOHOL. MAKE CERTAIN THE THROTTLE BORES ARE FREE OF ALL CARBON AND VARNISH DEPOSITS. RINSE OFF IN SUITABLE SOLVENT. BLOW OUT ALL PASSAGES IN CASTINGS WITH COMPRESSED AIR AND CHECK CAREFULLY TO INSURE THOROUGH CLEANING OF OBSCURE AREAS. CAUTION: DO NOT SOAK RUBBER PARTS OR POWER ADJUSTING ASSEMBLY (1A) TYPE C IN CLEANING SOLVENT.

REASSEMBLY

REASSEMBLE IN REVERSE ORDER OF DISASSEMBLY. NOTE SPECIAL INSTRUCTIONS.

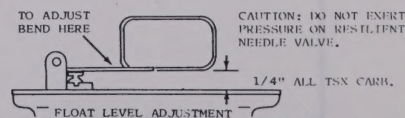
SPECIAL INSTRUCTIONS

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THROTTLE VALVE (17) INSTALLATION - INSTALL VALVE WITH ANGLE IDENTIFICATION MARK FACING FLANGE FACE OF CARBURETOR. TAP LIGHTLY TO CENTER IN THROTTLE BORE. TIGHTEN SCREWS SECURELY.

IDLE ADJUSTING NEEDLE (5) - TURN NEEDLE IN LIGHTLY UNTIL SEATED, THEN BACK OUT 1 TURN.

POWER ADJUSTING NEEDLE (1) OR (1A) - TURN NEEDLE IN LIGHTLY UNTIL SEATED. THEN BACK OUT 1 TURN.



MEASURE FROM GASKET SURFACE TO NEAREST EDGE OF EACH FLOAT. TO ADJUST, BEND FLOAT LEVER KEEPING EDGE OF FLOAT PARALLEL WITH GASKET.

IDLE ADJUSTMENT - ENGINE AT OPERATING TEMPERATURE, CHOKE VALVE COMPLETELY OPEN, ADJUST IDLE SCREW UNTIL ENGINE RUNS SMOOTHLY STAYING ON THE RICH SIDE OF THE ADJUSTMENT.

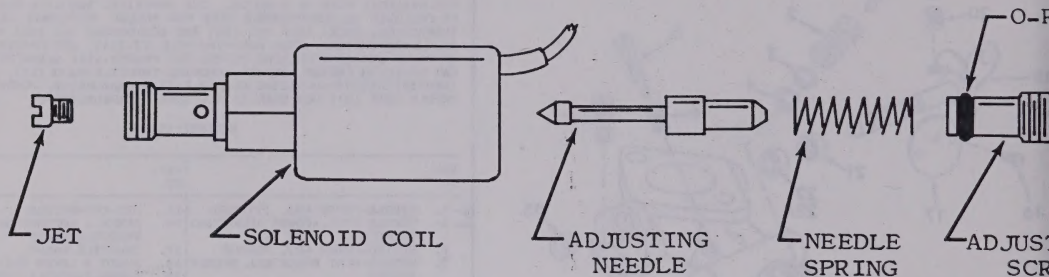
POWER ADJUSTMENT - ENGINE RUNNING AT GOVERNED SPEED UNDER LOAD, TURN POWER ADJUSTING NEEDLE CLOCKWISE UNTIL ENGINE BEGINS TO LOSE POWER, THEN BACK OUT UNTIL ENGINE PICKS UP POWER AND RUNS SMOOTHLY. A RICHER MIXTURE MAY BE NEEDED TO IMPROVE ACCELERATION.

NAPA (Ecklin) 2-1401

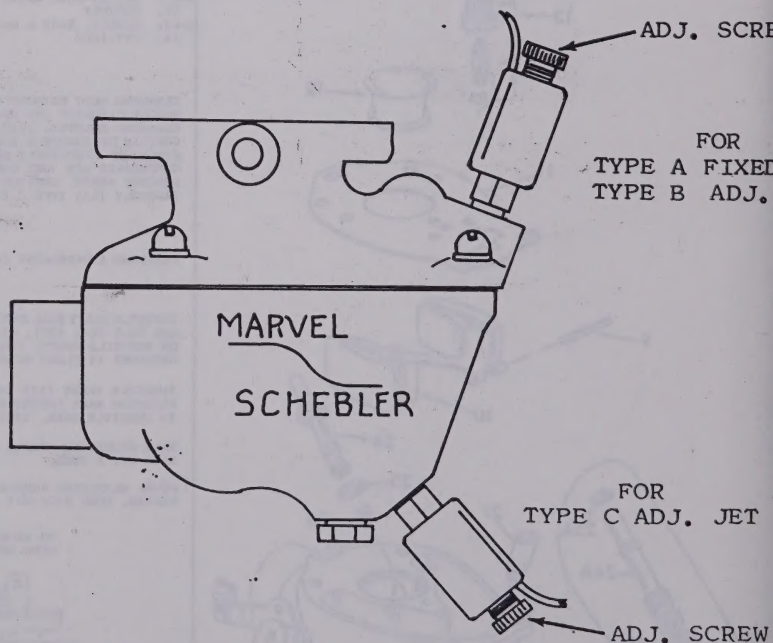
Viton Tip

SERVICE INSTRUCTIONS FOR CARBURETORS EQUIPPED WITH ANTI-DIESELING POWER ADJUSTING NEEDLES

REMOVE UNIT FROM CARBURETOR. DISASSEMBLE AS SHOWN. DO NOT TRY TO REMOVE O-RING. WASH IN CLEANING SOLVENT AND BLOW OFF WITH COMPRESSED AIR. CAUTION: DO NOT SOAK COIL ASSEMBLY OR RUBBER O-RING IN CARBURETOR CLEANER.



ASSEMBLY: LIGHTLY OIL O-RING AND REASSEMBLE IN REVERSE ORDER OF DISASSEMBLY.



PRELIMINARY SETTING. TURN ADJUSTMENT SCREW IN LIGHTLY UNTIL NEEDLE SEATS, THEN BACK OUT 2-3 TURNS. FINAL SETTING UNDER LOAD IN ACCORDANCE WITH YOUR ENGINE MANUAL.

Technit

- 40/93

778-505

TEMPORARY SERVICE PARTS LIST - INSERT IN THE PROPER SECTION OF YOUR MANUAL

Continental Engine FS162		Continental Motors #F162P-465	TSX-826
PART NO.	QUAN.	PART NAME	
4568	1	Carbureter Body Assembly	
1337	1	Throttle Shaft, Throttle Stop & Lever Assembly	
246	1	Fly - Throttle (18°)	
42	1	Screw (#8-32 x 3/4) Fill. Head (Throttle Stop)	
285	2	Screw (#8-32 x 5/16) Hex Head Slot. (Thr. & Choke Swivel)	
409	1	Screw (#8-32 Drill Plug) (Nozzle Hole)	
A82	4	Screw (#12-24 x 5/8) Fill. Hd. Sems (Throttle Body to Bowl)	
A91	4	Screw (#4-40 x 1/4) Bind. Hd. SEMS (Thr. Fly-2)(Choke Fly-2)	
A93	1	Screw (#8-32 x 3/8) Pan Hd. Sems (Choke Bracket to Bowl)	
A255	2	Screw (#10-32 x 3/8) Oval Head(Auto-Choke to Adapter)	
B20	1	Screw (#12-28 x 1/2) Hex Head Slot. Sems(Choke Bracket Clip)	
A296	1	Screw (#12-24 x 5/8) Slotted Hex Head (SEMS)(Governor Lever Clamp)	
A297	1	Screw (#10-24 x 7/8) Slotted Hex Head (Clevis Clamp)	
4	1	Gasket - Float Valve Seat	
80	1	Gasket - Throttle Body to Bowl	
449	1	Gasket - Main Nozzle	
491	1	Gasket - High Speed Needle	
592	1	Gasket Assembly	
262	1	Spring - Throttle Stop Screw	
281	1	Spring - Governor Lever	
340	1	Spring - Idle Needle	
A1	1	Spring - High Speed Needle	
670	1	Choke Lever Assembly - Complete	
869	1	Choke Shaft & Lever Assembly	
573	1	Choke Fly Assembly	
108	1	Swivel Choke Lever	
110	1	Swivel Throttle Lever	
175	1	Clip - Choke Bracket	
571	1	Choke Bracket & Stud Assembly	
572	1	Choke Bracket Assembly	
600	1	Float & Lever Assembly	
27	1	Shaft - Float Lever	
33	1	Needle - Idle Adjusting	
619	1	High Speed Needle Assembly-Complete	
627	1	High Speed Needle Assembly	
63	1	Packing Throttle Shaft	
A132	1	Venturi - (25/32") Diameter Throat	
712	1	Nozzle Assembly	
101-L	1	Jet - Idle	
279	1	Power Jet	
230	1	Cup - Throttle Shaft	
231	1	Retainer - Throttle Shaft Packing	
257	1	Bushing - Governor Lever	
167	1	Pin-Throttle Stop	
247	1	Pin-Choke Stop	
299	1	Washer - High Speed Needle	
A4	1	Washer - Clevis Assembly	
171	1	Drill Plug - Idle Drilling	
1	1	Nut - #10-24	
14	1	Cotter Pin - Throttle Shaft	
16	2	Cotter Pin - Choke Swivel-1 (Throttle Swivel-1)	
7	1	Plug - Bowl Drain	
O-216	1	Adaptor - Choke	
504	1	Clevis Assembly	
A75	1	Washer - Choke Bracket Stud	
ge -1-		TSX-826 replaces the TSX-793	

TEMPORARY SERVICE PARTS LIST - INSERT IN THE PROPER SECTION OF YOUR MANUAL		
Continental Engine FS162		Continental Motors #P162P-465
		TSX-826
NO.	QUAN.	PART NAME
791	1	Governor Lever Assembly
744	1	Throttle Body Assembly
336	1	Float Valve, Seat & Gasket Assembly (Matched)
006	1	Automatic Choke Assembly (12-volt)
353	1	Repair Kit

page -2-

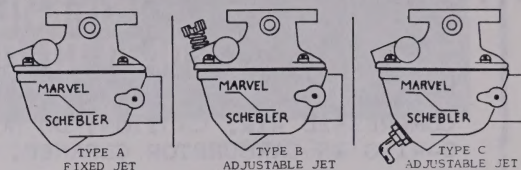
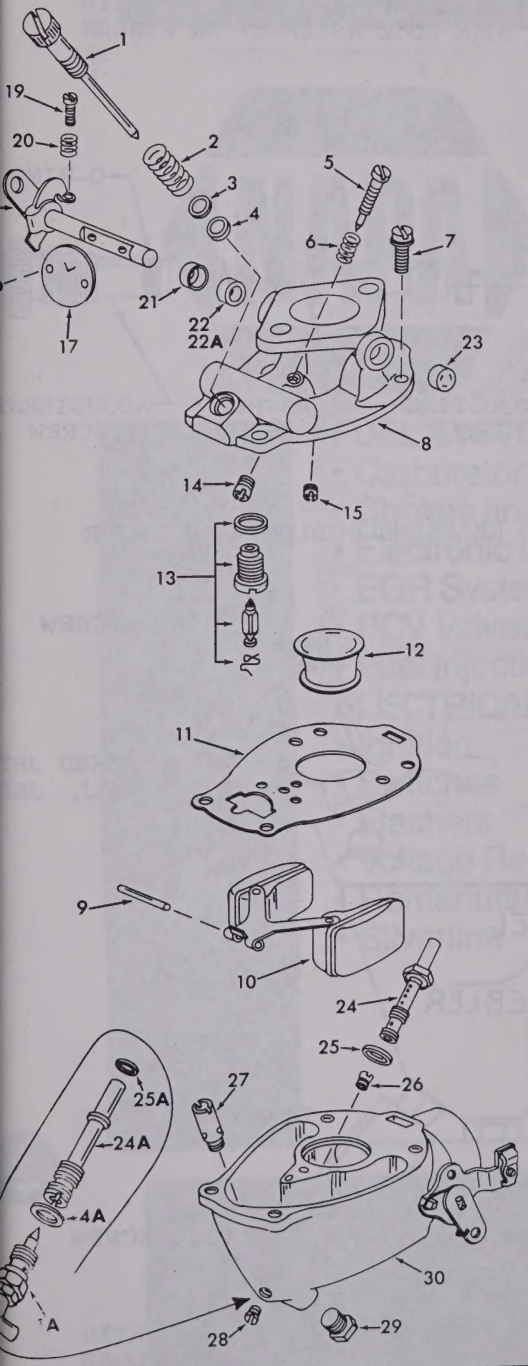
TSX-826 replaces TSX-793

VAN'S CARBURETOR & ELECTRIC
1091 KENTUCKY AVE.
INDIANAPOLIS, IND. 46221
(317) 634-8691

MARVEL-SCHEBLER CARBURETOR MODEL-TSX

GENERAL EXPLODED VIEW

THE GENERAL DESIGN AND PARTS SHOWN WILL VARY TO INDIVIDUAL UNITS COVERED ON THIS INSTRUCTION SHEET



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4. GASKET-POWER ADJ. NEEDLE	19. SPRING-THROTTLE STOP SCREW
4A. GASKET-POWER ADJ. NEEDLE ASSY. (TYPE C)	20. RETAINER-THROTTLE SHAFT SEAL (FELT)-THROTTLE SHAFT
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7. SCREW & LOCKWASHER (4) - BOWL COVER	23. NOZZLE-MAIN (TYPE A-B)
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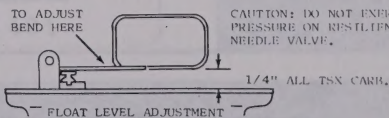
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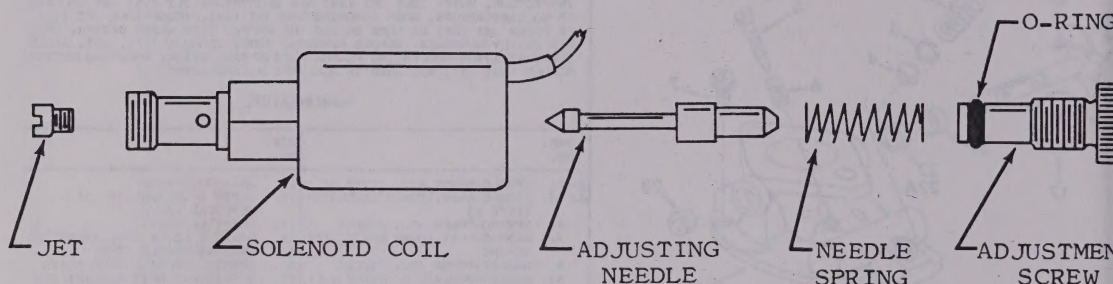
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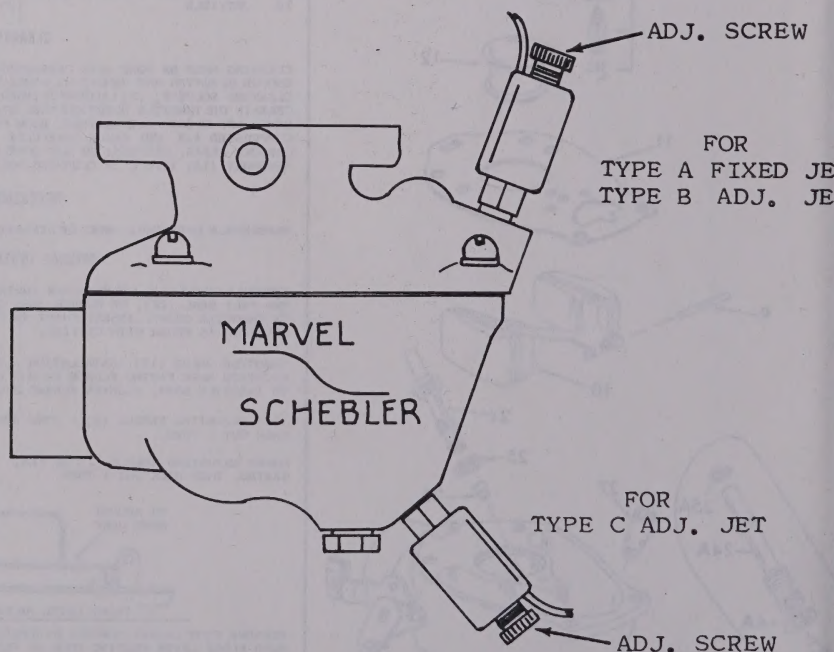
NAPA (Echlin) 2-1401 - Viton Pip

SERVICE INSTRUCTIONS FOR CARBURETORS EQUIPPED WITH ANTI-DIESELING POWER ADJUSTING NEEDLE

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MFG. FOR NAPA
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CRB.2-1401

2-1401

CUSTOM TAP



2-1401

Breaking this seal prohibits the return
and/or crediting of this carburetor kit.

**40
93 778-505**

TECHLIT® Information Enclosed.

*For Marvel-Schebler
Carburetor model
TSX 826-62-5*



HAROLDS CARBURETOR
& ELECTRIC SERVICE Inc.
920 Broadway (219) 426-1563
FORT WAYNE, INDIANA 46802

PARTS & REPAIRS
INVOICE

DATE	INVOICE NO.	PAGE
09/02/94	6200	1

CASH

YEAR MAKE CASH
LICENSE NO.
MILEAGE
VIN

PHONE
WHEN READY YES ☐ NO ☐

SALES PERSON	CUSTOMER P.O. NUMBER	TERMS		
P		CASH	N	N

PARTS AND SERVICES PERFORMED			TOTALS
1401	CARB KIT	30.81	0.00 30.81
VAPA (Ecklin)			30.81
SUB TOTAL			30.81
SHOP SUPPLIES-WASTE REMOVAL			
TAX			1.54
INVOICE TOTAL			32.35
TUNE UPS & EMISSION--HEATER & AIR CONDITIONING--BRAKES			
ER & ALTERNATOR--ELECTRIAL--COMPUTER DIAGNOSTIC & REPAIR			
CHANGE & LUBE---THANK YOU FOR YOUR BUSINESS			
Paid Dave			

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the repair work to be done along with the necessary material.
and/or your employees permission to operate the vehicle
streets, highways, or elsewhere for the purpose of testing
express mechanic's lien is hereby acknowledged on above
amount of repairs made. Dealer not responsible for
delays in parts shipments on and dealer's control.

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FOR LOSS OR
DAMAGE TO CARS
OR ARTICLES LEFT
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assumes nor authorizes any other person to assume for it any liability in connection with the
sale of the vehicle parts or service.

Warning this seal prohibits the removal
and/or cracking of this carburetor jet.

48
93 778-305

Ford Manual - Schetter
Carburetor - mild

Ford
Mild



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Stewart Warner Corp.

South Wind Division

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Indianapolis, IN.

Phone (317) 267-1616 Bill Shelton

317 632-8411

Model 939-D24

Serial 1545

24 Volt, 11 amp start

1 amp run

